THE UNIVERSITY OF ALBERTA

A COMPARISON OF THE INDUSTRIAL ARTS PROGRAM OF SASKATCHEWAN TO FOUR OTHER INDUSTRIAL ARTS PROGRAMS

by

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A THESIS

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The undersigned certify that they have read, and recommend to the faculty of graduate studies for acceptance, a thesis entitled, "A Comparison of the Industrial Arts Program of Saskatchewan to Four Other Industrial Arts Programs," submitted by Pete P. Driedger in partial fulfillment of the requirements for the degree of Master of Education.

ABSTRACT

The purpose of this study was to describe the program of industrial arts education in the Province of Saskatchewan and to compare it to four selected contemporary industrial arts programs.

The method used was one of categorizing statements from the most recent literature available dealing with the industrial arts programs studied. The programs studied were: (1) the high school industrial arts program in the Province of Saskatchewan; (2) the industrial arts program at the University of Alberta; (3) Face and Flug's American Industry Project at Stout State University; (4) Towers, Lux and Ray's Industrial Arts Curriculum Project at Ohio State University; and (5) Maley's study of Industry and Technology for Contemporary Man at the University of Maryland.

Published and unpublished literature describing each of the five programs were reviewed and eight criteria constituted the basis used for description and comparison of the programs. The criteria used were:

1. Objectives

2. Source of content for industrial arts in relation to industry

3. Organization and development of content

4. Provision made (by the administrative unit that put the program into practice) for vocational education and career preparation in senior high school

5. Activities carried out and methodology used

6. Grade structure for industrial arts

7. University programs and student teaching offered to industrial arts students

8. Experimentation of curriculum material before curriculum innovation

Some findings of the study were: (a) All programs had very specific objectives. (b) All programs advocated a type of multiple activity laboratory instruction for industrial arts education in the junior high schools. (c) All programs looked to practices by contemporary industry as a source of content.

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CHAPTER I

Introduction

Relatively little professional writing and research is available in industrial arts. An explicit and consistent rationale that has influenced practices in the field of industrial arts is difficult to find. Evans states:

> Any field quickly can become moribund if it lacks adequate research. Industrial arts is no exception. The speed with which danger becomes imminent is particularly great if allied or competitive fields are developing rapidly. The extensive changes occurring in technology, occupational structure, availability of free time and leisure time, population, lengthening periods of school attendance, and the host of similar developments are well known (Rowlett, 1966, p. 6).

There has been increased activity, both in industrial arts research and curriculum innovation during the 1960's. The passing of the Vocational Education Act of 1963 in the United States prompted industrial arts educators to re-examine their role and critically evaluate their function as a part of general education. In many cases, federal monies were available to researchers in the United States for such purposes. A counterpart to this development took place in Canada following the passing of Bill C-49. Federal monies in Canada, however, were not available for research and curriculum improvement projects in industrial arts.

A general attempt to continue to improve educational offerings in the Province of Saskatchewan is taking place. One of the areas which is undergoing examination and innovation is that of industrial arts. The study reported here is a part of that examination.

The Problem

The purpose of this study was to describe the program of industrial arts education in the Province of Saskatchewan and compare it to selected contemporary industrial arts programs.

The comparisons were between (1) the high school industrial arts program in the Province of Saskatchewan, (2) the industrial arts program at the University of Alberta, (3) Face and Flug's American Industry Project at Stout State University, (4) Towers, Lux and Ray's Industrial Arts Curriculum Project at Ohio State University, and (5) Maley's study of Industry and Technology for Contemporary Man at the University of Maryland. Other programs could undoubtedly have been selected as the basis of comparison, but the literature generally agrees that the developing programs at Alberta, Ohio, Stout and Maryland exemplify innovative thinking in industrial arts education.

Importance of the Problem

The legislature of Saskatchewan has provided for industrial training, technical training, vocational training, and industrial arts education, but no over-all review and analysis of any of these programs has been made, in Saskatchewan.

Prior to the establishment of the new vocational

education facilities in Saskatchewan, industrial arts performed a dual function (Department of Education, 1966a, p. 1): (a) contributing to general education in the junior and early senior high school program, and (b) providing vocational education in the final years of the senior high school program. The consensus of the curriculum committees in Saskatchewan was that this dual purpose was no longer necessary, nor desirable.

Studies of Bonsor and Mossman (1924, pp. 3-18), Hornbake (1957, pp. 14-15), and Hostetler and Young (1959, p. 3), brought Saskatchewan curriculum committees of industrial arts to a consensus on two points.

> (a) Industrial arts education is a part of general education.
>
> (b) Industrial arts education is concerned with interpreting the world of work with industry as a salient component, to all youth. (Department of Education, 1966b, p. 3).

Procedure of the Study

No attempt was made in this study to evaluate the respective programs reviewed here.

The comparisons between the programs utilized information which could be classified under eight criteria. The criteria were derived by locating various commonalities within the five programs. For the placement of information within the respective criteria logical deduction (including a minimum of subjective judg-

ment) was used.

The criteria were:

1. Objectives.

2. Source of content for industrial arts in relation to industry.

3. Organization and development of content.

4. Provision made (by the administrative unit that put the program into practice) for vocational education and career preparation in senior high school.

5. Activities carried out and methodology used.

6. Grade structure for industrial arts.

7. University programs and student teaching offered to industrial arts students.

8. Experimentation of curriculum material before curriculum innovation.

Data for this study were obtained from various sources, such as (a) Books, (b) Publications of the Department of Education in Saskatchewan, (c) Publications of the government, learned societies, and other organizations, (d) Periodicals and, (e) Unpublished materials.

Definitions

The following definitions of terms used in the study reported here provided a common frame of reference across all programs reviewed:

Industrial Arts. The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their value, and the problems of life related to these. (Bonsor and Mossman, 1963, pp. 70-71).

Program. Subject areas in the various curriculums have their material substances of subject matter organized into programs. For the purposes of this study, program is defined as the manner of the arrangement of industrial arts subject matter: it is not the subject matter itself. (Gallagher, 1963, p. 75).

Unit Shop. An organizational plan for teaching trade and technical subjects where students concentrate on one type of shop work. There is just one single major activity as contrasted with a multiple activity program. Examples: printing, woodworking, or machine shop. (Silvius and Curry, 1956a p. 463).

Career. A profession or other calling demanding special preparation and undertaken as a lifework (Webster's Collegiate Dictionary).

Vocational education. An educational program to assist persons in securing the skills, information, attitudes and understandings that will enable them to enter employment in a given occupation or field of work, or to make advancement in that occupation after they have entered it. (Silvius and Curry, 1956b, p. 463).

Activities. The major divisions of work in a general shop or multiple activity program such as bench woodworking, metalworking, electricity, or plastics are considered as activities. (Department of Education, 1966c, Saskatchewan, p. 5).

Multiple Activity Laboratory. It is a laboratory or shop where two or more activities are in progress at the same time. (Department of Education, Saskatchewan, 1966c, p. 5).

Limitations of the Study

All five selected programs are currently in the research or developmental stage. The method of the study therefore, was limited to program content rather than the actual implementation of that content. Information was not available in full detail from all programs for all the criteria.

Introduction to the Text

Chapter II is a brief introduction to each of the programs reviewed. In addition to this, and as a part of the introduction to the Saskatchewan program, a brief history of the development of shopwork in Saskatchewan is presented.

Chapter III is a description of the five programs in the study. All information available for each program is compared under the eight criteria used.

Chapter IV contains the description of the programs (by criteria) of (a) Saskatchewan, (b) results of the findings for the other four programs combined, and (c) a general comparison of the findings of (a) and (b).

Chapter V consists of a general summary of the study, conclusions, and recommendations.

CHAPTER II

An Introduction to Five Contemporary Industrial Arts Programs

The order in which the five programs are presented (including a brief history of the Saskatchewan program only) is as follows: (1) the high school industrial arts program in the Province of Saskatchewan; (2) the industrial arts program at the University of Alberta; (3) Face and Flug's American Industry Project at Stout State University; (4) Towers, Lux and Ray's Industrial Arts Curriculum Project at Ohio State University; and (5) Maley's study of Industry and Technology for Contemporary Man at the University of Maryland.

Industrial Arts in Saskatchewan

History

Legislation. In 1905, when Saskatchewan became a province, the curriculum of the high school specified the teaching of manual training courses. These courses later became known as shopwork. Still later, legislation provided for industrial training, which was a type of training that was to educate the mind through the hands and to develop skills through the eye. Out of this industrial training the three-year industrial course was systematized and later changed to a four-year technical program, providing industrial training for grades 9-12 inclusive. Legislation authorizing manual training was passed in 1911,

(Statutes of Saskatchewan, 1910-11, Chapter 25).

In 1913 an amendment to The School Act gave the board of any district the power (Statutes of Saskatchewan, 1912-1913, Chapter 35):

1. To make such provision as it deems advisable for giving instruction in its school in manual training, industrial training, domestic science and physical training;

2. To make such provision as it deems advisable for industrial evening schools in which persons employed during the day may receive theoretical and practical instruction in the trades or occupations with related instruction in English, mathematics, drawing, science, history and geography;

3. To appoint an advisory committee of at least seven members, the persons so appointed to be resident ratepayers of the municipality in which the school is situated and be selected on the ground of competence to give advice and other assistance in the management of such classes or schools as may be established under the foregoing subsections.

It was realized at the time that manual training could not be introduced in the rural schools because of the cost involved in obtaining equipment, so "handiwork" in paper modelling was introduced since it involved very little expense. Manual training also induced teachers to stay in their schools longer, kept the students at school, and also kept the school open for a longer period of time (Statutes of Saskatchewan, 1912-1913, Chapter 35).

Industrial Training. The Royal Commission on Industrial and Technical Education visualized a rather extensive system of schools for Industrial Training and

Technical Education. They referred to the system as a "Dominion Development Policy" (Report of Royal Commission on Industrial Training, 1913, pp. 239-262). Provisions were made under the following headings: (1) for those who were to continue at school in urban communities; (2) for those who had gone to work in urban communities, and (3) for those in rural communities.

The Royal Commission suggested a Federal grant to the provinces to assist in vocational work. The commission recommended, in part (Report of Royal Commission on Industrial Training, 1913, p. 79):

> The Commission is of the opinion that the teaching of Drawing, Manual Training, Nature Study, Experimental Science and Pre-Vocational Work (including Domestic or Household Science) in Elementary Schools is of great importance and value and should be provided for generally.
>
> Having regard to the cost of carrying on these branches in the Elementary Schools, until teachers are available who themselves have been taught them during their school days and bearing in mind that such school work was not contemplated as part of public education at the time of Confederation when the Provinces accepted the responsibility of legislating for the maintenance and control of education within their borders, the Commission ventures to recommend that a Fund be created from which payments would be made to Provincial Governments during a period of ten years.
>
> The Commission suggests that such a Fund should receive not less than $350,000 a year for ten years from a Dominion Parliamentary Grant ...

The Commission's report was not adopted by Saskatchewan. The Commission modified their recommendations by establishing Technical Institutes in later years.

Not until 1919 was The Technical Education Act passed, giving grants to the provinces for vocational education. This Act not only provided for subjects or fields of education for men, but it greatly assisted in the spread of home economics in Canada (Encyclopaedia Britannica, 1968, Vol. XI, p. 621).

The Saskatchewan Educational Commission reported that by 1913 industrial evening classes were being given in Moose Jaw and Saskatoon. These classes were designed for those people engaged or about to engage in industrial vocations. At Moose Jaw the subjects of carpentry, metal machine work, copper work, electricity, and drafting were taught. Saskatoon offered practical woodworking and mechanical drawing twice a week for the whole year of evening classes.

Industrial work courses. The Vocational Education Act (Statutes of Saskatchewan, 1919-20, Chapter 42) introduced industrial work courses (that prepared students for an occupation) in 1920 in high schools and collegiate institutes. Practicability was stressed in handling tools, in the ability to make repairs, and in the understanding of machinery. Sheet metal, metal lathe work, forge work, and the study of the properties of common metals were introduced as students progressed in their studies.

Academic subjects were prescribed together with the industrial courses. The pupils who completed any of the vocational courses (including industrial work) could, upon passing an examination in either geometry or algebra, be admitted to the second class sessions of the Normal Schools (1936-1937, Regulations and Courses of Study for High Schools, Section 8).

Industrial Vocational Schools. In 1931-32, the "Industrial Work" became an "Industrial" course in Vocational Schools. In the first year various subjects such as motor engineering, metal work, electricity, house carpentry and joinery, drafting, and art were prescribed. The academic requirements of English, history, mathematics, science and health were further requirements in the Vocational Schools. In the second year health was deleted, while in the third year physics or chemistry was added. A foreign language was considered an optional subject for each of the three years.

Academic and vocational course changes remained in effect until 1936-1937 when the "General Course" was introduced for students not intending to proceed to University or Normal School (Regulations of Courses of Study for High Schools, 1936-37, Section 8).

By 1938 the School Grants Act (Statutes of Saskatchewan, 1938, Chapter 52) and the Secondary Education Act (Statutes of Saskatchewan, 1938, Chapter 50)

were amended to make grants available for instruction of pupils above grade eight in shop work. By 1944 vocational program courses were put on a par in class time with the academic high school program. The former stressed that students become skilled craftsmen and acquire a broad theoretical knowledge which would fit them for positions of responsibility in modern industry. This vocational course remained in effect until 1950.

Smaller Centers. In 1944 (Statutes of Saskatchewan, 1944, Chapter 41) the Saskatchewan Legislature passed The Larger School Unit Act whereby a number of the smaller school districts were united under the control of a single board of trustees of the unit. With more money available for the building and maintaining of one large school in place of many smaller schools, a number of administrative units developed vocational education programmes. Other units established composite high schools, while still others began the itinerant type of program in which one instructor spent one day a week (during the summer months) at the various schools in his area (bringing all tools and equipment with him), and a month at a time in each of these schools during the winter months when travelling was more difficult. All students (of the schools involved) from grades seven through twelve had an opportunity to take vocational education courses.

Curriculum Bulletin D. In 1957 the Department of Education of Saskatchewan authorized course outlines for technical and vocational subjects. The authorization was known as Curriculum Bulletin D. Curriculum Bulletin D was written with the composite high schools in mind. Composite high schools had been organized in many of the larger school communities in Saskatchewan by 1957 (Department of Education, 1957, Curriculum Bulletin D, p. 1). The composite high schools represented a distinct change in the philosophy of secondary education: At this time there were still many high schools in the province with technical facilities operating as academic schools. It was felt that such institutions were not performing the functions of composite high schools. According to the Curriculum Bulletin D introduction, the concept of the composite high school was based upon the belief that it was the democratic right of students to have equal opportunity for preparation while in school for life beyond school, whether for the entering of professions, the home, the farm, business, or the skilled trades. The composite high school was not to be considered a vocational school, since it was not designed nor equipped for offering many technical courses on a full trade level. The composite high school was there to lay a broad, solid foundation in the various technical fields which would assist in the transition from school to a

life work. The composite schools were to offer a well balanced program for all students with the academic subjects and technical subjects nicely blended in accordance with students' plans (Department of Education of Saskatchewan Curriculum Bulletin D, 1957, p. 1).

The Curriculum Bulletin D made provision for grade nine and ten students to take commercial, home economics, basic shopwork, and vocational agriculture subjects. The grade eleven and twelve students followed a similar pattern, but they were given more shop credits and shop time per year than the grade nine and ten students. The students in grade nine and ten taking shopwork were required to take four types of shop courses in order to give them broader background for the more specialized work of grade eleven and twelve where two subject related courses (for example, mathematics and science) were required.

The course of basic shopwork as given in the Curriculum Bulletin D was not considered as either industrial arts or trade training. The Curriculum Aims and Purposes states:

> The course can best be defined as one in general vocational-industrial training. It is not industrial arts since it has a more specific end in view, yet it is not a course in trade training since it does not specialize in job proficiency. The primary aim is to provide basic experiences in the fundamental skills and related theory of several trade fields to the end that upon

completion of high school, students will be better prepared to meet mechanical problems as they arise on the farm or in future trade courses of apprenticeship or trade schools. (Department of Education, 1957, Curriculum Bulletin D, p. 55).

The Curriculum Bulletin D is still in use in some areas in the Province of Saskatchewan, but changes have been made, and are still being made, to develop an up-to-date curriculum guide to suit the present needs of the province. For example, in 1966, "The Approved Portion of Industrial Arts Curriculum" for Division III (grades eight and nine) was released by the Saskatchewan Department of Education. Its introduction reads as follows:

> Industrial education in Canada has gone through a period of rapid change. In Saskatchewan this change has resulted in a critical examination of the industrial arts program, culminating in a revised course designed to meet the needs of students who must become aware of a highly technological society.
>
> . . . .
>
> Some of the major developments which are having an impact on the educational environment are: (1) Increased industrialization and technological developments which have produced changes in both the occupational classifications in Saskatchewan and requirements for entrance into occupations; (2) Increased mobility of the population in Saskatchewan and Canada which has resulted in attempts to equalize education opportunities in rural and urban centers; and (3) Increased and more diversified student population currently in secondary schools. (Department of Education, 1966,

Saskatchewan, Curriculum Guide p. 1).

At the present time plans are being made for the development of the Division IV industrial arts Curriculum for senior high school.

<u>Current Industrial Arts Program for Junior High Schools</u>.

The Saskatchewan program is one of multiple activity. It is organized so that a variety of exploratory experiences can be presented with a minimum of space and equipment. One laboratory can be divided into as many areas as chosen. Each area is large enough to accommodate up to six students. These areas are as self-contained as possible with provisions made to store the students' projects and tools. The class is divided into groups with each group working through the course unit in the area assigned. This allows for the rotations from area to area about every six weeks.

The multiple activity laboratory affords each student the opportunity to observe the various technologies. This assists the students in getting acquainted with the basic tools (Department of Education, 1967, Saskatchewan, pp. 6-7).

Short lectures and demonstrations are given to the pupils of one area, and the remainder of the time is given to assist the individual. The instructor also present, lectures and demonstrates to the total class.

These lessons rotate from group to group with material given to the students from their prospective units. For later review information sheets supplement the lesson. The instructor then reviews the theory with the individual groups.

In junior high schools this program is offered to grades eight and nine. For these grades there is a suggested organization of teaching units. The units selected are governed by the maturity of the pupil involved, the equipment available, and the expertise of the instructor. The instructor must be able to handle successfully the particular areas that are chosen. For example, grade eight has wood 1, metals 1, electricity-electronics 1, and graphic communications 1. The additional areas that might be chosen could be graphic arts 1 and 2, plastics 1, electronic-computer 1 and 2. A similar teaching unit can be organized for grade nine.

The general instruction is supplemented with instruction sheets consisting of operation sheets, job sheets, information sheets, and assignment sheets. These serve as teaching aids and contain organized material for the use of individual students (Department of Education, 1967, Saskatchewan, p. 8).

The University of Alberta Program

This program is divided into four phases, three designed to give a different perspective on productive society, and one to provide a deeper study into a selection of areas covered in the first three. (Ziel, 1966, Report I).

Phase I: The Tools, Machines, Materials, and Processes of Industry.

This aspect of the program is taught to grade seven pupils. It consists of six major areas.

1. Electricity. Pupils have the opportunity to become aware of the sources, control and uses of electricity. Rather than achieve depth in any aspect of the utilization of electrical energy, they have the opportunity to explore as many different sources and uses as possible.

2. Ceramic Materials. This affords the pupils an introduction to the tools, machines, materials and processes used in the ceramic industries. This area may include studies of concrete, glass, abrasive materials and processes as well as modern developments.

3. Plastics. An introduction is given to the multitude of plastic materials and how they are formed into useful products.

4. Metals. Casting, machining, and powdered metallurgical processes that are used with a variety of

metals are explored in this area.

5. Woods. In this area the industrial wood processes such as forming, strength laminating and composition products are experimented with by the pupils.

6. Graphic arts. This area helps to integrate all other areas. The graphic arts processes are unique in that many processes are used, and all materials made by man can be utilized (Ziel, 1966, Report I).

Phase II: The Technologies.

Modern industry can be differentiated into seven separate technologies. It is important to note, however, that these technologies are all interrelated and in actual practice are usually closely integrated. This phase is designed for grades eight and nine.

1. Communication Technology. Some areas of consideration in this technology are photographic processes, mechanical drawing (to be considered as technological communication), and audio communication systems.

2. Computer Technology. An awareness of computer functions in relation to modern industry is introduced in this area.

3. Electronic Technology. The utilization of electrical energy for control and the application of

electronics to the other technologies is a major area of study.

4. Mechanical Technology. This is a wide field in the study of gears, transmissions, gear trains, and others, in relation to various mechanical power train systems.

5. Power Transmission Technology. The problems of controlling and transmitting power to a point remote from the control center are examined. This area includes hydraulic, pneumatic and synchronous electrical sustems.

6. Power Technology. Students explore effective ways in which man uses the raw materials and energy available to produce power in a usable form, an d explore unique characteristics and limitation s of various power producing machines.

7. Testing. Testing is don e to all materials and processes in industry. The most commonly known are destructive and non-destructive testing of materials. Also explored are quality control systems.

Phase III: Man and Industry.

This phase is designed to provide:

> . . . educational experiences that expose students to the role of man and his function in relation to the technoligical demands imposed upon organizations and their members as they function within the parameters of an individually oriented society (Ziel, 1966, Report 1. page 12).

In Phase III man is considered in his interaction with his environment and with other people. It is advocated for grade ten students.

Phase IV: A Cluster of Technologies.

This phase is designed for grades eleven and twelve. A student begins to obtain depth in a cluster of three of the areas from Phases 1 and 2. An example of a cluster would be the areas of mechanical technology, power technology and power transmission technology.

In order to effect the University of Alberta Industrial Arts Program a multiple activity laboratory is utilized. The multiple activity laboratory offers the most economical method of providing a multiplicity of experiences.

Stout State Project

Face and Flug have attempted to develop an industrial arts program based on concepts of industry. They define concept as:

> . . . a psychological construct resulting from a variety of experiences (detached from the many situations giving rise to it), fixed by a word or idea, and having functional value to the individual in his thinking and behavior (Face and Flug, 1965a, p. 65).

Industry is defined as:

> . . . a complex of organizations that utilize the basic resources of man, materials, machines and money to produce goods, or provide services to meet the needs of man. (Face and Flug, 1965b, p. 6).

They see the objectives of industrial arts as developing an understanding of those concepts that apply directly to industry and developing the ability to solve problems directly related to industry. A model of the structure of industry is developed as a circle with concepts such as management, materials, financing, and processing on the circumference of the circle with all concepts interrelated. The main distinction made by the authors between their program and others is that their program is an attempt to categorize understandings rather than industries, materials or occupations.

This program is being attempted on an experimental basis in schools in Wisconsin and Minnesota. The emphasis is on developing concepts, and a process of using programmed materials to lead to concept formation is utilized.

Ohio State Project

This research project has as its purpose to:

> . . . rigorously define content; develop a package of teaching materials; field test, demonstrate and disseminate these materials; and organize teacher education programs. (Towers, Lux and Ray, 1967a, p. 3).

A structure for specifying content for industrial arts was developed on three dimensional matrices, the matrices going from general to specific. The first order matrix has as its axes:

1. Industrial material goods.
2. Industrial production technology affecting humans and materials.
3. Industrial management technology affecting humans and materials.

All additional matrices are derived from this initial construct. The frame of reference for the first order matrix is praxiological knowledge, or "knowledge of practice"; practice referring to the act of carrying out a productive activity using other kinds of knowledge.

The content ranges from the historical industrial development of man (Towers, Lux and Ray, 1967b, p. 2) to categorizing the practices in changing the forms of materials (Towers, Lux and Ray, 1967c, p. 101). All this material is structured according to the matrices discussed above. The content is organized in great detail, with specific topics to be covered each day.

The classroom interaction consists of discussions, laboratory activity, and teacher presentations (Towers, Lux and Ray, 1967e, p. 1). Reading assignments and workbook activities form an integral part of the program. The teacher presents material and supervises the laboratory experiences.

Since the activity varies from classroom lectures to laboratory experiences, and since the whole class does the same things together each day, the likely facilities required will be a standard classroom and a

general shop.

Industry and Technology

For Contemporary Man Project

This program is an attempt to:

> . . . provide an inter-disciplinary (economic, psychological, sociological, industry, and education) approach to the better understanding of industry and technology. (Maley, 1965a, mimeograph).

The basis for the program is:

> . . . an analysis of the society in which the program would function, an analysis of the psychological elements that were related to school in providing programs of substance and work. (Maley, 1965b, mimeograph).

The content is organized for grades seven, eight, and nine. For grade seven an anthropological (e.g. the evolution of tools) approach to tools and machines, power and energy, communication and transportation is adopted. In grade eight a contemporary approach to the study of American industry is developed through an in-depth study of an industry by two methods, a group project, and a line production experience. In grade nine the approach is personal with emphasis on the psychological needs of the individual, and increasing depth in the students' chosen areas of industry. Experiments are conducted with materials, products, and processes of industry, using the scientific method.

Students are allowed to choose their own projects

at the grade nine level. The social interaction of the group is part of the educative process in the group projects and line production. The teacher's role is to give direction and maintain quality performance. He is to guide the pupils in the pursuit of their problems, establish community contacts for better information, and organize field trips for enrichment. At the grade nine level the students are involved in a seminar once a week to discuss their problems; the teacher is the group leader.

CHAPTER III

Analysis of Industrial Arts Programs

Chapter III is a detailed description of each of the five programs reviewed and analyzed. The description is presented by program for each of the criteria. It will be recalled that the eight criteria used are:

1. Objectives

2. Source of content for industrial arts in relation to industry

3. Organization and development of content

4. Provision made (by the administrative unit that put the program into practice) for vocational education and career preparation in senior high school

5. Activities carried out and methodology used

6. Grade structure for industrial arts

7. University programs and student teaching offered to industrial arts students

8. Experimentation of curriculum material before curriculum innovation

The programs presented in this chapter are in the following order: (1) the high school industrial arts program in the Province of Saskatchewan; (2) the industrial arts program at the University of Alberta; (3) Face and Flug's American Industry Project at Stout State University; (4) Towers, Lux and Ray's Industrial Arts Curriculum Project at Ohio State University; and (5) Maley's study of Industry and Technology for Contemporary Man at the University of Maryland.

Province of Saskatchewan

Introduction

In recent years Saskatchewan introduced its plan for a reorganized school system. The Saskatchewan Department of Education is replacing the traditional 8-4 grade organization by four divisions each consisting of three years of school for a student making normal progress. In Divisions I and II the principle of non-grading, involving the concepts of continuous progress and flexible promotion, were approved. The Division III program was planned to meet the needs of the junior high school student. The curriculum planners believed the student needed a guidance program in order to provide him with an adequate background for continuing satisfactory progress and for intelligent selection of courses in the senior years of school.

In Division IV the total scope of courses offered and the content and methods used within particular subject areas changed. The program gave emphasis to courses in the vocational and industrial-technical fields and to the fine arts.

The objectives of the new Division III Curriculum made a profound impact on the curriculum content for industrial arts in Saskatchewan.

Criterion No. 1 Objectives

The Department of Education Division III Steering Committee established particular functions for the junior high school. These functions were in addition to the functional objectives of secondary education. It was considered important that instructors of industrial arts interpret the junior high school program not only in relation to the functional objectives of secondary education, but more particularly to the achievement of the functions of the junior high school. The functions are:

1. To provide for the further development of basic skills and learnings required in Divisions I and II.

2. Through a limited exploratory program in such areas as the fine arts, modern languages, occupational studies, and guidance, to provide a broad base for making educational decisions, and for the development of a continually widening range of cultural interests.

3. Through a program of sufficient flexibility within courses to provide better opportunities for meeting the individual differences of students.

4. Through a greater degree of staff specialization to prepare the students more adequately for the Division IV program.

5. Through specially trained staff, to provide an effective guidance program.

6. Through a program of school-fostered, co-curricular activities, to awaken interest and encourage participation in social, recreational and civic activities in order

to satisfy the adolescent's quest for normal growth towards maturity.

Objectives of Industrial Arts for Division III are:

a. To develop an understanding of our changing industry and its place in our culture.

b. To foster discovery and development of talents in technical fields and applied sciences.

c. To develop a measure of skills in the use of common tools and machines.

d. To develop and extend problem solving skills related to materials and processes.

Expectations for Industrial Arts Division III are:

1. Instill an awareness of change as a feature of contemporary life.

2. Appreciate contributions by people in different occupations.

3. Appreciate our productive potential.

4. Appreciate the advantages and problems of our industrial and technological society.

5. Provide outlets for creativity.

6. Generate interests for profitable use of leisure time.

7. Promote personal development and social competence.

8. Promote student sensitivity of the need for continuing education.

9. Contributes to laying a base for making realistic occupational choices.

10. Build and promote good work habits and attitudes.

11. Contributes to consumer competence.

12. Develops and promotes safety habits.

13. Contributes to worthy home membership.

14. Provides for the articulation of other subjects.

15. Develops manual dexterity.

16. Serves therapeutic functions (Curriculum Guides, 1967a, p. 3).

The functions, expectations, and objectives serve as a framework for interpreting the junior high school program of Division III.

Criterion No. 2: Source of Content for Industrial Arts in Relation to Industry

Regarding industrial arts in relation to industry, Saskatchewan's Approved Portion of Industrial Arts Curriculum Division III states:

> A good industrial arts program affords students an insight into American industry, the source of raw materials, how basic materials are processed, how products are designed and produced, and how people earn a living. (Curriculum Guide, 1966, p. 2).

The curriculum guide further states that all people are consumers and users of products of industry: therefore, the student should understand the industrial procedures of manufacturing or preparing for the process of manufacturing consumer goods. In order to

understand the industrial procedures of manufacturing the curriculum source content was taken directly from industry.

To understand the industrial procedures the student is to become involved in the study of fundamental tools, material and industrial processes, and acquire an understanding of industry and technology. It is believed that the industrial arts experience provides opportunities for students to work together in developing an article of value in a "mass production" procedure similar to that of industry. That is, the students are expected, first, to design and develop pilot models to provide them with the meaning to the the function of the engineer and industrial designer in industry. In this manner the students calculate the cost of manufacture, determine the sales price, design and develop jigs and fixtures, and arrange the available manpower to mass produce twenty-five or more articles in the industrial arts class. These industrial procedures give the students a view of the various occupations and professions in their relationship one to another as seen in industry and also assists them in understanding the technological environment in which they live (Curriculum Guide, 1967b, p. 3).

According to the material available, Saskatchewan developed curriculum material to acquaint the

student with some industrial experiences. Examples of reference to industry for the Saskatchewan industrial arts program follow.

> Drafting: "It seems desirable that young people should learn to communicate technical ideas effectively through the language of drafting to better understand and contribute to technological progress as participating members in this society" (Curriculum Guide, 1967d, p. 10).
>
> "Drawing is the language of technology" (Curriculum Guide, 1967d, p. 10).
>
> Woodwork: "To develop some fundamentals of industrial operations and processes" (Curriculum Guide, 1967e, p. 21).

The quotations just mentioned provided some of the source content from industry of the Saskatchewan industrial arts curriculum in relation to industry.

Criterion No. 3: Organization and Development of Content

The Division III industrial arts school program is a multiple activity program. To reach the objectives of industrial arts education the year's work of industrial arts may consist of six subjects taught in six different areas, but all in one lab.

Criterion No. 4: Provision Made for Vocational Education and Career Preparation in Junior and Senior High School

Junior High School. Industrial arts education gives "an opportunity for helping students make career

choices" (Curriculum Guide, 1967i, p. 2).

The curriculum guide further states that if industrial arts is taught properly, the broad spectrum of skills, knowledges, understandings, and attitudes learned by the student are directly applicable to most occupations and professions. The following quotations give information that assists a student in career preparation.

In drafting for the junior high school students, one of the specific objectives is to:

> Introduce the student to the field of drafting as graphic communication, its practices, tools, materials and possibilities as a vocation (Curriculum Guide, 1967i, p. 10).

In metals one of the activities is to "discuss careers in this field."

One of the general objectives of electronic computer study is:

> To develop an understanding of the basic principles of the operation of analog and digital computers and to enable them to determine if their career might be in this field (Curriculum Guide, 1967k, p. 38).

<u>Senior High School</u>. Senior high school, or Division IV consists of grades 10, 11, and 12. The senior high school industrial arts program offers a balanced range of courses to accommodate all adolescents capable of profiting from instruction at this level. It allows for occupation preparation leading

directly into employment, and gives more emphasis to courses in the vocational and industrial technical fields and the fine arts (Division IV Program Prospectus, 1967a, pp. 1-3).

The Vocational-Occupation Program is designed to offer a student trade subjects. For example, trowel trades, cabinet making, landscaping, tailoring, sheet metal, service station services, art and general business are all offered in the option courses for the senior high school student preparing for a trade. For the student to complete his grade twelve in the Vocational-Occupational Program, he would have to take the "core subjects" (as given in the time table of Criterion 5) to qualify. This means five core subjects and three or four options (Division IV Program Prospectus, 1967b, p. 4).

In the mechanical field of the senior high school program, a Division IV Technical Vocational Curriculum was completed in 1966. To make provisions for vocational education in senior high school the curriculum is divided into Levels I, II and III as outlined in Appendix B. Level I offers the introductory mechanical technology courses leading to particular careers.

In Levels II and III only those students who have mastered the previous level in the sequence and express a continued interest in mechanical technology

are admitted to the program. Those students who do not master or are not interested in further mechanical technology education beyond Level I may elect to take welding, machining or automotive trades beginning at Level II. These courses are at the trade level and articulate with the apprenticeship program. (Technical Vocational Curriculum, 1966a, p. 111).

For students selecting the industrial-technical programs there is the provision of the related subjects to prepare the students better for a future career.

Criterion No. 5: Activities Carried Out and Methodology

For the industrial arts activities in a multiple activity lab nine possible areas are divided into 16 units. If a student spends two years in Division III he would have covered from 7 to 10 units. The outline of studies for the activities is as follows:

Areas of Study	Units
1. Metals 1 and 2	2
2. Wood 1 and 2	2
3. Plastics	1
4. Electricity/Electronics	2
5. Power Mechanics	2
6. Graphic Communications (Drafting and Blue Print Reading)	2
7. Electronic Computer	2
8. Graphic Arts (Type Setting, Printing, Silk Screen, Book Binding)	2
9. Photography	1
9 areas	16

(Curriculum Guide, 1967l, pp. 6-7).

The project method is advised for the woods,

metal, and plastics areas. Electricity, electronics, computer technology, and power mechanics lend themselves to an experimental approach activity.

The drafting course consists of thirty hours of activities that acquaint the student with linear measurement, lettering, lines and flat layouts, simple pictorial drawing, introduction to orthographic drawings, geometric construction, dimensioning, blueprint reading, and reproduction of drawings. (Curriculum Guide, 1967m, pp. 10-19).

The bulletin for senior high school does not outline methods to be used in teaching but does state the objectives, content and activities.

The unit also serves as an introduction to drafting for some students and a review for others and includes drafting fundamentals necessary for continuance in the drafting phases of all three technologies; that is, construction, mechanical, and electrical-electronics technologies.

Criterion No. 6: Grade Structure for Industrial Arts

The grade structure for industrial arts has not been fully agreed upon as yet. Harley stated:

> Nearly three years ago a sub-committee for Industrial Arts Curriculum was appointed. The committee was made up of representatives from the Department of Education and practising teachers both in the fields of Industrial Arts and Industrial Arts/Vocational Education. The

> terms of reference were to develop a curriculum in Industrial Arts for Grades 7, 8 and 9 in the new Division System. Despite vigorous protests to the Division III Steering Committee, this central authority ruled that the programme should be restricted to Grades 8 and 9 only. Most of the reasons given, such as lack of time and need for more remedial work, are still far from convincing to many of the committee members, just as they have failed to be valid in many other provinces in Canada (Canadian Journal, 1967a, pp. 8-14).

Criterion No. 7: University Programs and Student Teaching Offered to University Industrial Arts Students

University Programs. In Saskatchewan the program for Industrial Arts teachers was planned to meet requirements for the General Bachelor of Education Degree, to provide technical competence in the teaching major, and to enable candidates to acquire a teaching minor in a chosen academic field (General Calendar of the University of Saskatchewan, 1967-68, p.G. 22). The courses available, course outlines, and various requirements for industrial arts teachers are given in Appendix B.

The courses of industrial arts offered at the Saskatchewan Institute of Applied Arts and Sciences, Saskatoon, are divided into two semesters. The two semesters are offered in cooperation with the College of Education, University of Saskatchewan, for the subject matter preparation of prospective teachers of industrial arts in the schools of Saskatchewan. The courses are designed to provide them with a broad background

in successful laboratory demonstration to intermediate and secondary school students.

The course of studies mentioned consists of an introduction to applied principles of arts and sciences in the fields of materials, processes and energy, and includes helpful laboratory activities and tours of local industry (Calendar of Courses of the University of Saskatchewan, 1966-69, p. 18).

Student Teaching for Industrial Arts Teachers

There was no special student teaching mentioned in the Saskatchewan University Calendar for industrial arts university students.

Criterion No. 8: Experimentation of Curriculum Material before Curriculum Implementation

Saskatchewan had fourteen Division III industrial arts programs in operation during the 1967-68 school year that could be classified as multiple activity programs. Reports of procedures were not available from all programs.

Further experimentation of curriculum material will take place in 1968-69.

Summary

Saskatchewan's program of industrial arts education has undergone an abrupt change; the direction appears clear, but it has not, as yet, had sufficient time to implement the changes envisioned.

The University of Alberta

Introduction

According to the Alberta program:

> Industrial Arts has been conceived as that part of general education which lends understanding to the technological and industrial aspect of Society (Research Report 1, 1966a, p. 6).

To meet the existing demands of general education, a new industrial arts program was developed in Alberta. The Alberta program of industrial arts is a sythesizing educational process conducted in a multiple activity environment. The program is intended to make a distinct contribution to secondary general education. It is envisioned as a four-stage (or phase) program which includes grades seven through twelve (Research Report I, 1966b, p. 7). Ziel stated that:

> As a synthesizing educational environment, Industrial Arts can reinforce the command of academic disciplines. The multiple activity environment introduces boys and girls to a variety of experiences designed to interpret the current Productive society and provide a base to make a more intelligible vocational choice (Research Report, 1966c, p. 9).

Criterion No. 1: Objectives

1. To provide an environment where students can reinforce and apply the academic disciplines.

2. To provide exploratory experiences in the various productive aspects of society.

3. To provide a synthesizing educational environment.

4. To provide an introduction to the multiplicity of career opportunities.

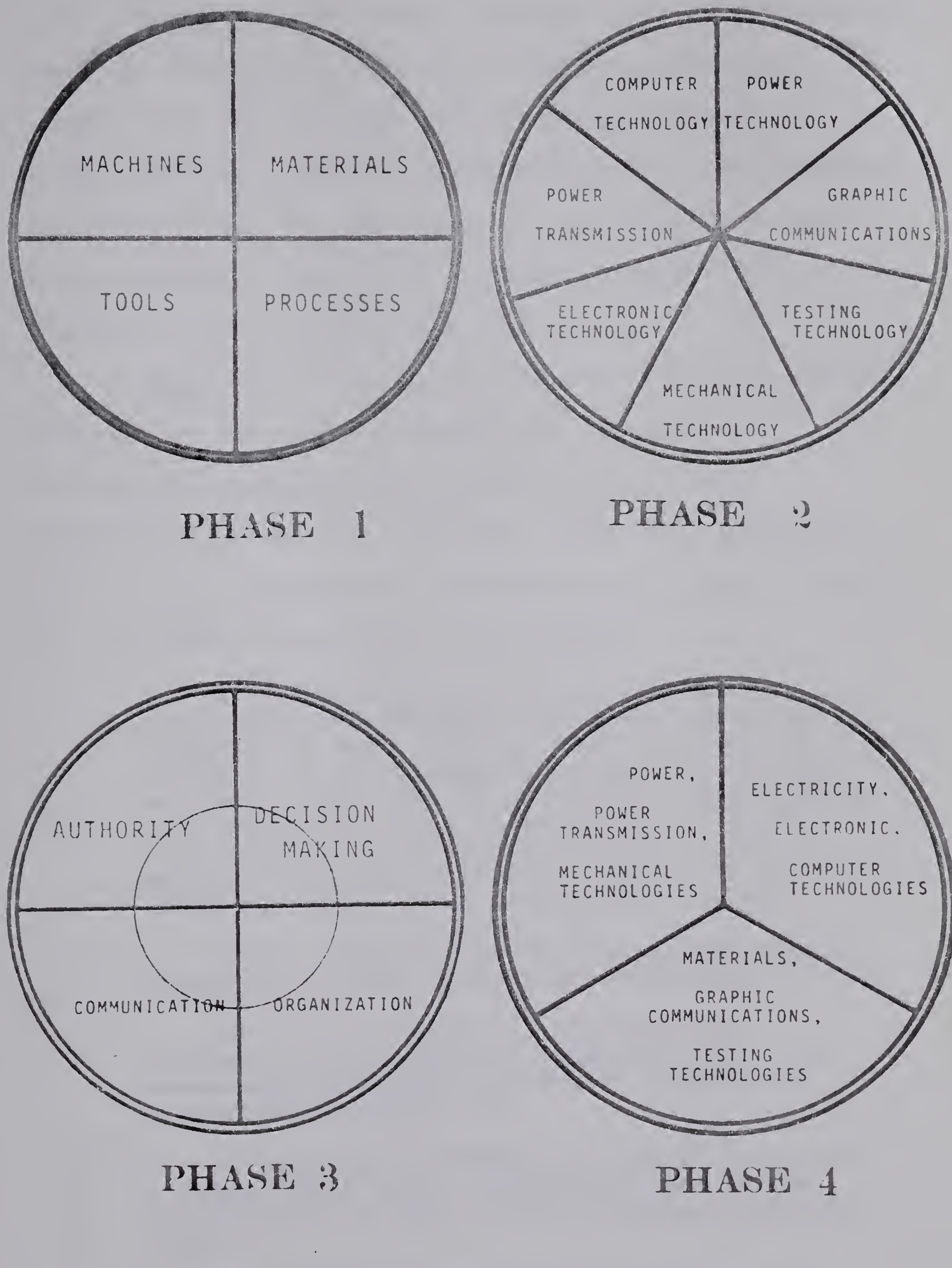
Criterion No. 2: Source of Content for Industrial Arts in Relation to Industry

The Alberta Program of Industrial Arts advocated that the exponential technological growth rate must be reflected in education if our young men and women were to obtain the knowledge to face the challenge of technology and learn to live in this involved and changing world (Bulletin, Industrial Arts, 1966a, p 2). The Bulletin further stated that:

> Industrial arts as a part of general education, provides a synthesizing educational environment in which our youth will develop an understanding of productive society. Industrial arts imparts to the student an awareness of the relationships existing between the academic disciplines and the world of work (Bulletin, 1966b, Industrial Arts, p. 2).

Criterion No. 3: Organization and Development of Content

The program was designed to make a jointed contribution to secondary general education, having envisioned four phases which would be followed from grade seven through grade twelve. By using the multiple activity approach it was believed that the students would be introduced to varied experiences designed to interpret the present vocational choice (Industrial Arts Conference, 1967b, p. 104).



The Alberta University Program

Figure 1

Phase I. The Phase I multiple activity environment was designed to introduce grade seven students (boys and girls) to, and develop an appreciation of, tools, machines, materials and processes. To accomplish an introduction and appreciation, six material areas were provided. These were ceramics, graphic arts, plastics, woods, metals and electricity.

Phase II. Peculiar to the University of Alberta Program are the seven technologies (in Phase II) considered representative of the world of work (Gallagher, 1963a, pp. 132-133). They are considered basic to all institutions in the world of work. Regarding the seven technologies Ziel stated:

> Understanding the world of work is a very large undertaking. As industrial arts teachers we must look for factors which are inherent in all productive organizations when we take up the task of selecting content which will facilitate this understanding. We find that regardless of the institution's role, whether it be raw material, product or service, there are some common denominators in all.
>
> Tools, machines and materials play a profound role in all productive organizations.
>
> Certain technological processes are inherent in all kinds of organizations, e.g. communication, power and power transmission electricity-electronics.
>
> All business enterprises have an authority configuration that is imposed by the formal organization as well as the informal organization.
>
> All organizations create pressures which have profound influences upon the effective-

> ness of employees and upon the entire population.
>
> All organizations involve some degree of specialization and are faced with the problem of integrating specialized skills and knowledges into a productive society (Ziel, 1963, p. 21).

Phase III. Phase III provided educational experiences that expose students to the "role of Man and his function in relation to the technological demands imposed upon organizations and their members as they functioned within the parameters of an industrially oriented society" (Research Report I, 1966e, p. 12).

Phase IV. Phase IV was designed to give students the opportunity to pursue a cluster of related technologies. These technologies were selected from Phases I and II and provided a combination of technologies in greater depth and breadth within a research and development context.

Criterion No. 4: Provision Made for Vocational Education and Career Preparation in Junior and Senior High School

There were no provisions made for vocational education in the University of Alberta Industrial Arts Program.

Regarding exclusive skill training Ziel said:

> He who trains himself too exclusively in a particular set of skills runs the risk

> of finding them outmoded, perhaps even before he has mastered them (Conference Proceeding, 1964b, p. ix).

One of the objectives of the University of Alberta Industrial Arts Program is, "To provide an introduction to multiplicity of career opportunities", but does not refer to vocational training in any part of the high school education.

Criterion No. 5: Activities Carried Out and Methodology Used

The University of Alberta Industrial Arts Program was found to use a variety of teaching methods and a unique combination of instructional hardware and software. Each laboratory was equipped with a student-centered inter-com and magnetic tape system designed to: (a) provide pre-recorded instruction separately for each area, (b) provide individual intercommunication between each area and the teacher, and (c) enable the teacher to monitor recorded instruction in each area (Industrial Arts Conference, 1967e, p. 106).

The tape system and inter-com enabled the students to select audio instruction according to their individual needs and rate of progress. It also served the purpose of self-instruction for the student and relieving the teacher from repetitive instruction.

For further student-centered instruction single-

concept films were used. In each lab area students were able to view three 5-minute films on demonstrations suited to their needs. They could view these films as often as needed.

Each laboratory was also equipped with teaching machines and programmed pictorial instructions to provide a variety of instructional materials and to facilitate better learning conditions. The teaching machines were used mostly for students in covering technical content and theoretical material related to their actual laboratory activities. The programmed pictorial instructions were used as a supplement to guide the students in the sequence to be followed when operating machines. This method acted as a self-teaching device for the student, encouraged reading, and saved time for the instructor.

All the learning activities and instructional materials were organized on a student product matrix in each area. This assisted the student in coordinating his own activities and progress at his own desired rate of speed. The matrix approach to the various areas of learning also assisted the instructor in evaluating the student's performance and provided a separate performance view of each student's work.

<u>Criterion No. 6: Grade Structure for Industrial Arts</u>

In the University of Alberta Program of Industrial Arts all junior and senior high school grades were included. According to the Alberta School System this included grades seven through twelve. Grades eight and nine were both placed in Phase II. The Grade nine students in Phase II were to take a study more in depth after completing the various technologies in grade eight.

<u>Criterion No. 7: University Programs and Student Teaching Offered to University Industrial Arts Students</u>

<u>Student teaching</u>. Student teaching in the Department of Industrial Arts at the University of Alberta is integrated with the research programs that have been carried out. The integration assured the student teacher of being exposed to pupils of varying interests and abilities, and at the same time conducting lessons in a typical multiple activity laboratory under the guidance of departmental staff (Bulletin I, Industrial Arts, 1966d, p. 15).

The advantages seen in student teaching at the University laboratories were:

> First, the controlled environment of the University laboratories insure that the student teacher will have the opportunity to develop lessons reflecting the approach of the university and reinforcing the objectives of Industrial Arts.

> Second, the student teacher can gain experience with the latest developments in curriculum materials and equipment being explored by the department. (Bulletin I, Industrial Arts, 1966e, p. 15)

Criterion No. 8: Experimentation of Curriculum Material Before Curriculum Innovation

The research program begun by the Industrial Arts Department of the University of Alberta was to contribute to the development of the new industrial arts program.

The plan of research was designed to extend over a seven-year period and to include three developmental phases. The first phase was to give the researchers an opportunity to determine whether it was feasible to continue further in the selected program aspects, and whether the work being done was suitable. The second, or developmental, research phase provided the opportunity to simplify, clarify, and single out variables for evaluation in the following research phase. The third, or experimental phase, was designed to test all the developed media, methods, content and equipment union of the two phases to satisfy experimental research criteria (Research Report I, p. 14).

The first year of each phase of the Industrial arts research was to determine the feasibility of further research. The following two or three years were set aside as developmental research which was to precede "clinically orientated experimental

research". The feasibility aspect was seen as important prior to large development of material that may not be useful.

Through the research it was expected that content could be developed, and applicable methods and laboratory design could be proportioned with program direction.

For this research a student sample was made available from local school systems. Experimental and control groups were selected on the basis of previous year's academic average and Intelligent Quotient.

The experimental and control group (consisting of five classes each) was defined by the University of Alberta and selected according to ability levels as follows:

Group I	9th Grade Boys (Low Achievement)
Group II	8th Grade Boys (Average Achievement)
Group III	8th Grade Girls (Mixed Achievement)
Group IV	9th Grade Boys (Lowest Achievement)
Group V	9th Grade Boys (High Achievement)

The selection of these various groups resulted in a total of ten groups. Five were experimental and five were control groups. Both groups were treated to identical curricula except that each experimental group received multiple activity industrial arts. All received the Phase I treatment as described in the Industrial Arts Phases of the University of Alberta Program.

In 1966 and 1967 twenty groups of students, either as control or treatment groups, participated in the research project.

The students were from grades 7, 8 and 9 and were of varying levels of ability.

Summary. In summarizing the Alberta University Industrial Arts Program, it appeared to be (a) a multiple activity type program for all high school grades, (b) a program built on the philosophy that "no profession or occupational title operates in a vacuum, and (c) a program that emphasized "that part of a general education that lends understanding to the technological and industrial aspects of society".

The American Industry Project

Introduction

With assistance in grants from the Ford Foundation and the United States Office of Education the American Industry Project (Face and Flug) began the restructuring of industrial arts. To get a program of this nature under way Face and Flug realized that participation from various individuals and groups would be needed. Brief seminar discussions were began, out of which grew the new program, called AMERICAN INDUSTRY (Face and Flug, 1965a, p. 60).

Criterion No. 1: Objectives

The objectives of the study of American industry were very broad. They dipped into every facet of human life, which led the project committee to assume many responsibilities which were formerly considered the responsibility of other institutions. From this study came the conclusion that the central purpose of education is the development of the rational powers of man.

The American Industry Project stated that developing of the rational powers of man is the responsibility of the schools. The school must also guard and spread those knowledges which have been developed and clarified by the human intellect, and which interact with man's environment.

From this clarified purpose of education came the broad objectives of the American Industry program. They are:

1. To develop an understanding of those concepts which

directly apply to industry.

2. To develop the ability to solve problems related to industry. (Face and Flug, 1965c, p. 62).

The American Industry Project believes that these two objectives are not met adequately in our present secondary schools, and the project's goal is to develop a viable secondary program based upon a conceptual analysis of the perceptions represented by industry (Face and Flug, 1965d, p. 62).

<u>Criterion No. 2: Source of Content for Industrial Arts in Relation to Industry</u>

Regarding the source of content for industrial arts in relation to industry the American Industry Newsletter states (Face and Flug, May, 1967a, p. 1) that in American industry classes the laboratory is intended as a tool for learning the concepts of industry by making it possible to involve the students in meaningful applications of these concepts. The industrial arts laboratory should not be an end in itself, but rather, it should be a place where there is an introduction to as many tools and machines of industry as possible. In this way the source comes directly from industry, and thus affords the students a direct introduction as to what is required. The comparison of the essential characteristics of American Industry and Industrial Arts are:

Traditional Industrial Arts	American Industry
1. Composed of a detailed study of knowledges concerned with production in specific industries for pre-vocational or avocational purposes.	Composed of a study of the knowledges contributing to an understanding of the total institution of industry for general educational purposes.
2. The selection of specific industries from among the many possible choices has led to a multiplicity of laboratory and curriculum patterns, making a coherent, unified, national program most difficult to achieve.	The identification of a structure composed of underlaying concepts should make possible the development of a coherent, unified, national curriculum and the standardization of laboratory facilities.
3. Pre-selected skills representative of the industry under study, are identified and serve as the orientation for the course of study.	Concepts serve as the orientation for the course of study. Specific skills are introduced as they become necessary in the activities designed for the development of the concept.
4. Attempts to duplicate the tools and machines of industry necessary to develop pre-selected skills and specific knowledges.	Makes no attempt to duplicate the tools and machines of industry, but utilizes what facilities are needed to develop understandings of concepts.

(Face and Flug, 1965e, p. 64)

Criterion No. 3: Organization and Development of Content

Pert method. In organizing the content in relation to industry the American Industry Project used the "PERT" method network. The PERT network (Project Evaluation and Review Technique) was implemented so the course of activity could be charted by first estimating the proper sequence in which the events would happen and the time necessary to cause them to happen (Face and Flug, 1962a, pp. 1-12).

The project was divided into four phases. Phase 1 was planning period; Phase 2, the initial development and field testing of American industry; Phase 3, the experimentation; and Phase 4, the implementation of programs nationally (Gebhart, 1968a, Figure 2, p. 4).

The project is an experiment which aims to substitute for conventional industrial arts courses a curriculum which stresses understanding of the image of American Industry rather than skill development.

In order to effect this change of direction and emphasis, they have chosen a method that will identify and teach the unification concepts that have application in all areas of industry. This conceptual approach will prevent the fragmented approach that is facing industrial arts and will lead students to understand the systems of concepts and subconcepts applicable to all of industry and not just to a trade or some other narrow section of industry (Face and Flug, 1967b, p. 4).

Major Concepts. The project committee identified the struc-

A CONCEPTUAL STRUCTURE
OF THE KNOWLEDGES NECESSARY
TO UNDERSTAND AMERICAN INDUSTRY

Figure 2

ture of industry built around fourteen major concepts: energy, processes, materials, production, management, marketing, personnel and industrial relations, purchasing, research, physical facilities financing, public interest, transportation, and communication.

Major emphasis on secondary curriculum. The major emphasis was placed upon:

> A. The need of the secondary school to aid all people in developing an understanding of American industry.
>
> B. The procedure used in identifying those knowledges necessary to understand American industry.
>
> C. The classified specification of behavioral objectives, taxonomically structured.
>
> D. The development of a logical course sequence.
>
> E. The development of instructional materials for teacher and student (Gebhart, 1968b, p. 1)

To develop a meaningful curriculum it was necessary to identify a logical structure of generalized knowledges of industry. A conceptual structure for these knowledges was selected for four basic reasons:

> A. Simplicity is provided, making details meaningful and more easily remembered.
>
> B. Conceptual organization provides a stable way of structuring knowledge.
>
> C. Relationships are revealed, which in turn provide a unity of knowledge.
>
> D. Conceptual understanding allows for transfer and application of knowledge to various situations (Gebhart, 1968b, p. 1).

The project formally defined American industry as:

> an institution in our society which, intending to make a monetary profit, applies knowledge and utilizes human and

> natural resources to produce goods or services to meet the needs of man (Gebhart, 1968c, p. 3).

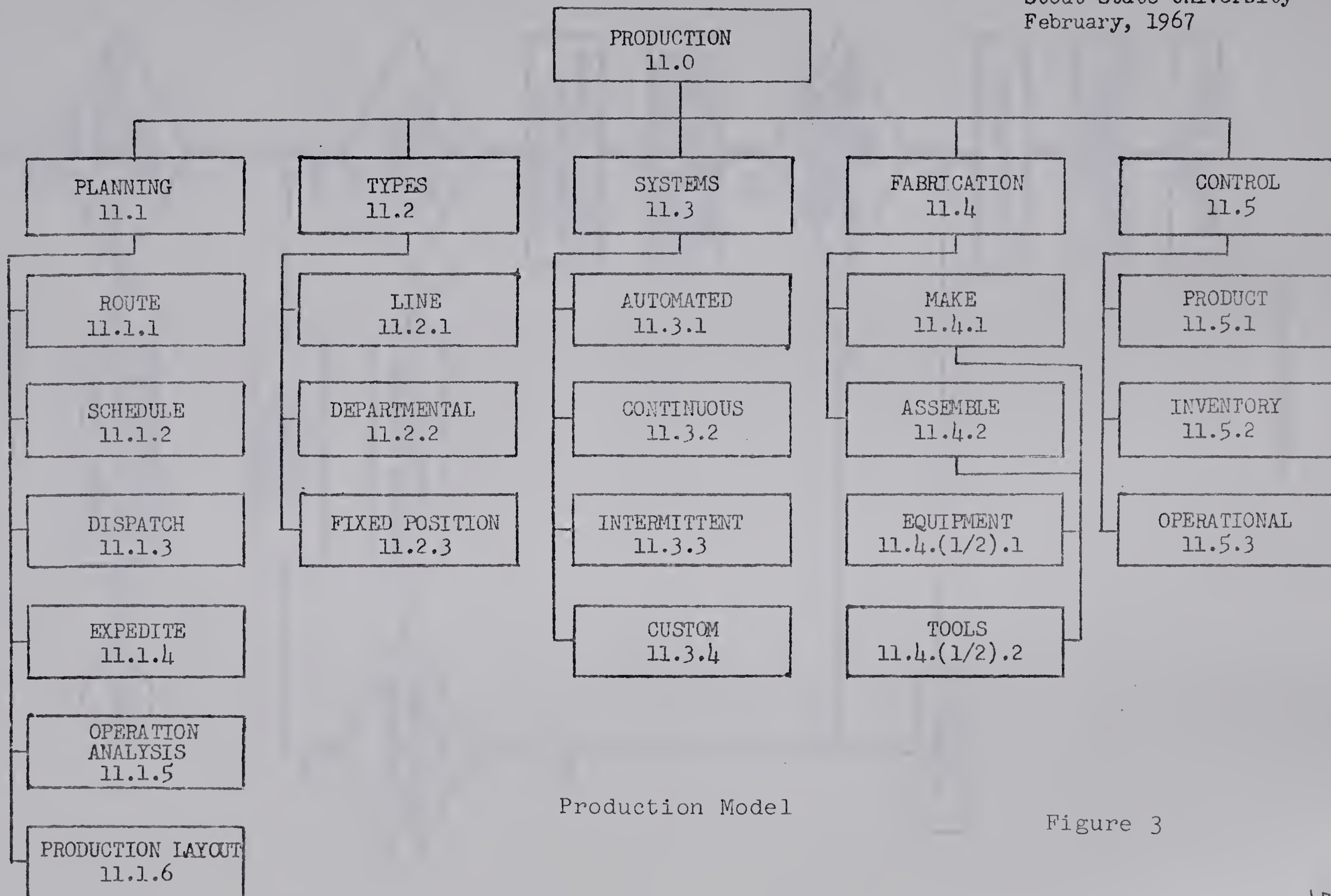
Next, a conceptual structure of knowledges necessary to understand American industry was developed. The structure consisted of two sub-sets of concepts:

> (1) those concepts which apply to any industry regardless of product or service and
>
> (2) concepts of our society that directly influence American industry in a manner that gives it a uniquely American character. (Gebhart, 1968d, p. 3).

After the conceptual structure of knowledge had been completed, conceptual models and definitions for each concept were developed. (See example of Production Model on Figure 2). Production was defined as "those activities of an enterprise which are primarily concerned with the generation of specified goods or services". Each concept and sub-concept was defined similarly in terms of their respective attributes (Gebhart, 1968e, p. 6).

Concepts, models and definitions. The American Industry Project staff consulted many teachers, members of the faculty of Stout State University, over two hundred industrialists, labour leaders and other professional personnel from the United States to assist in developing the concepts, models and definitions for the conceptual approach program. Information packets of the concepts, models and definitions were made available to all concerned. Then, with the definition of American industry as a guide, the American Industry Project staff systematically analyzed the consultant responses and refined the conceptual structure, the concept models

AMERICAN INDUSTRY PROJECT
Stout State University
February, 1967



Production Model

Figure 3

CONCEPT DEVELOPMENT

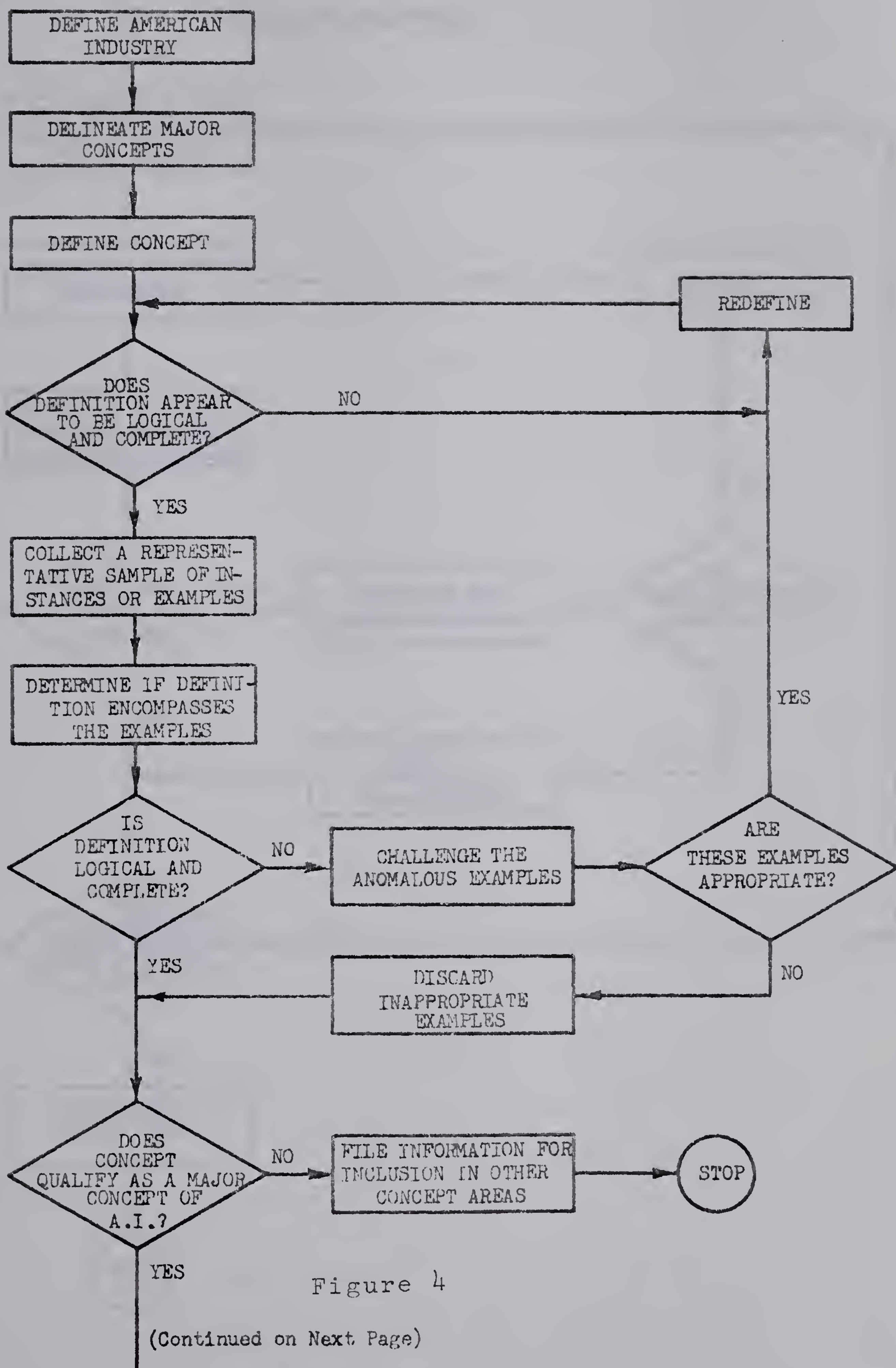
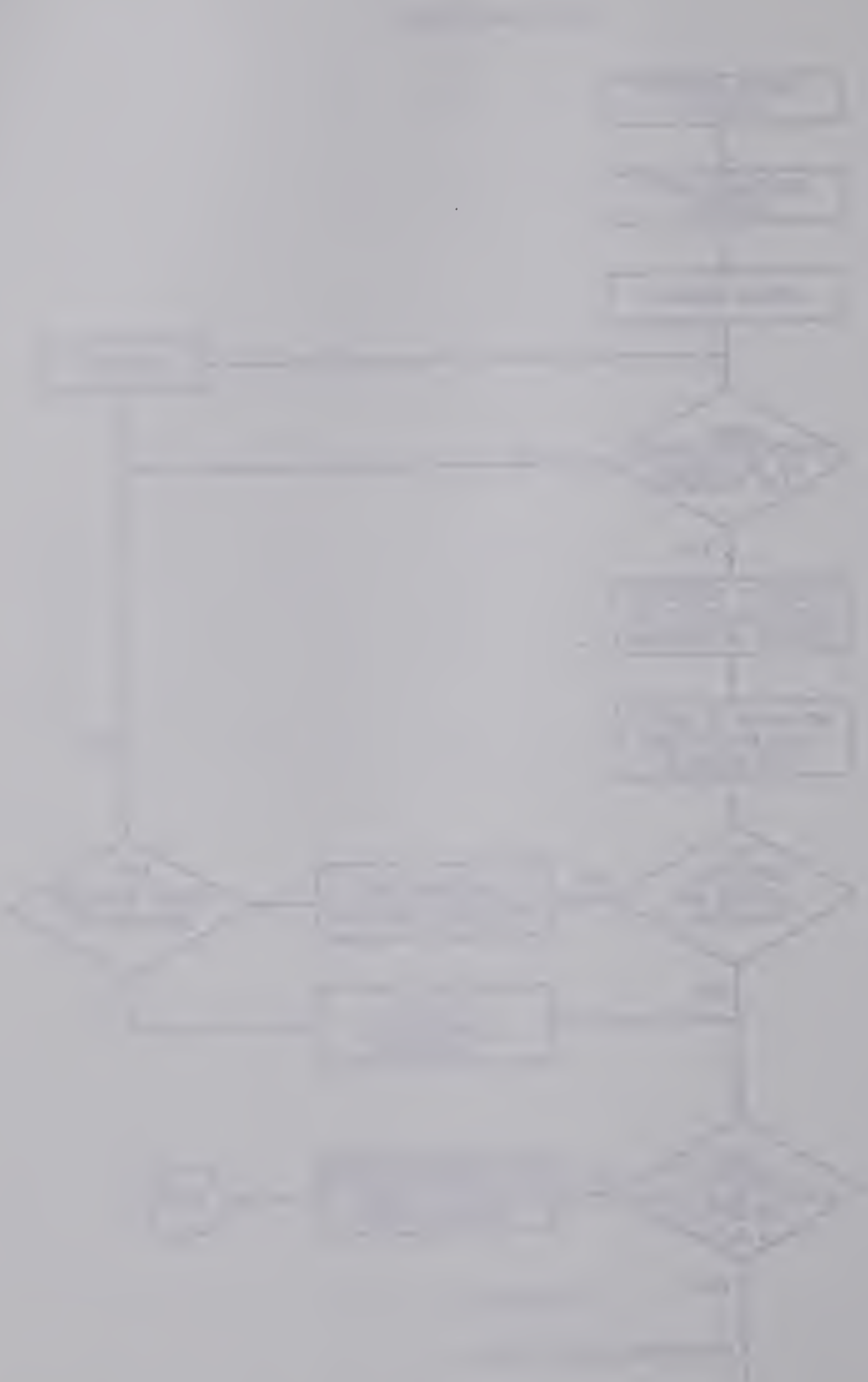
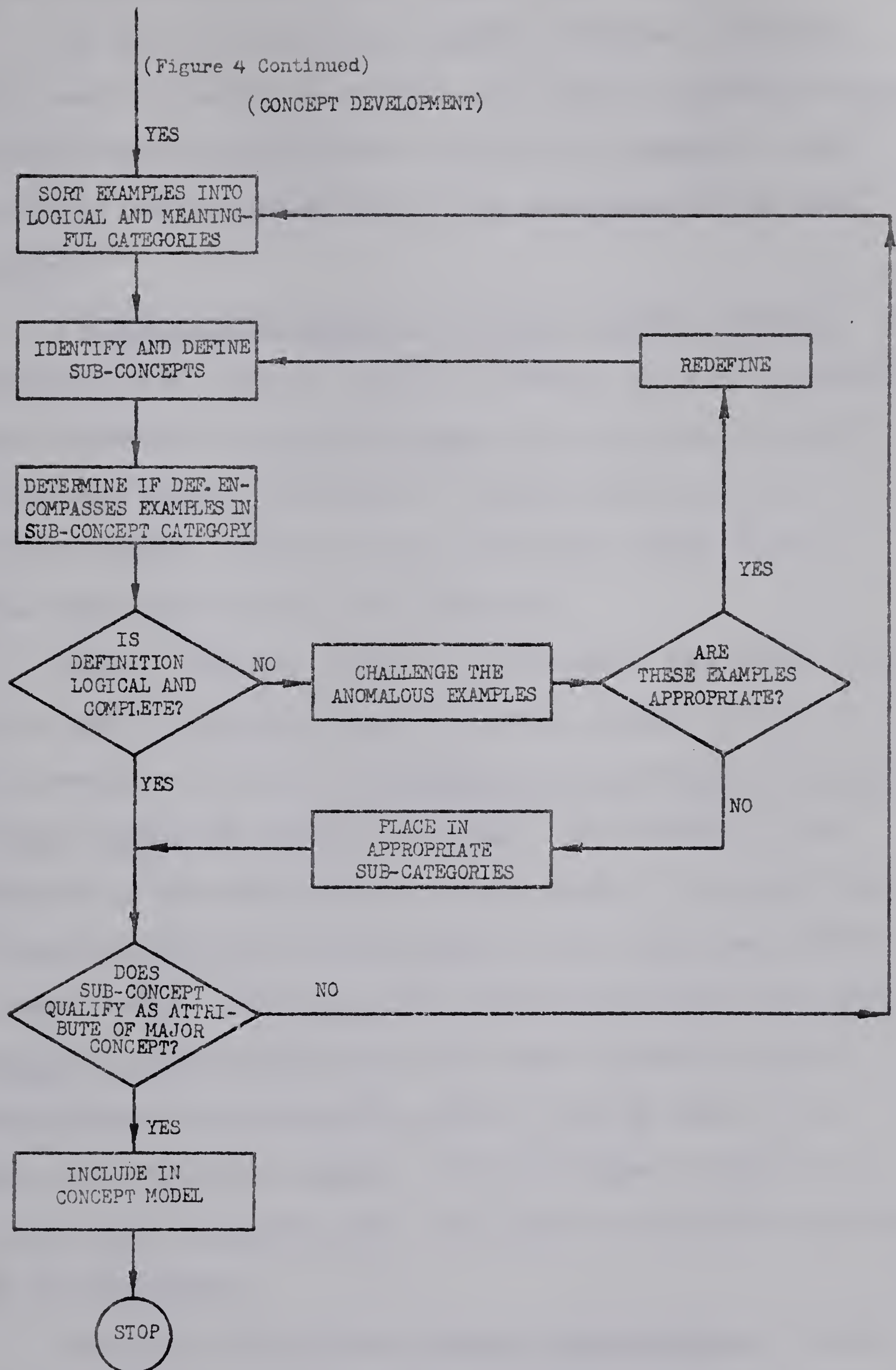


Figure 4

(Continued on Next Page)




(Figure 4 Continued)
(CONCEPT DEVELOPMENT)
YES
SORT EXAMPLES INTO LOGICAL AND MEANINGFUL CATEGORIES
IDENTIFY AND DEFINE SUB-CONCEPTS
REDEFINE
DETERMINE IF DEF. ENCOMPASSES EXAMPLES IN SUB-CONCEPT CATEGORY
YES
IS DEFINITION LOGICAL AND COMPLETE?
NO
CHALLENGE THE ANOMALOUS EXAMPLES
ARE THESE EXAMPLES APPROPRIATE?
YES
NO
PLACE IN APPROPRIATE SUB-CATEGORIES
DOES SUB-CONCEPT QUALIFY AS ATTRIBUTE OF MAJOR CONCEPT?
NO
YES
INCLUDE IN CONCEPT MODEL
STOP

and definitions (Gebhart, 1968f, Figure 4, pp. 8 and 9).

The use of the technique displayed in Figure 3 (Gebhart, 1968g, page 5) provided the project committee with a method of organizing and analyzing the work and logically developing it. About two and one half years was spent at the development of the total structure.

A Classification Breakdown of Level I American Industry. When speaking of level (level - a point of change), the American Industry Project referred to a point of change in the course objectives in the American Industry curriculum. There are three levels of American Industry. Level I is the first year: Level II, the second year; and Level III, the third year.

Figure 5 (Gebhart, 1968h, p. 11) reveals a taxonomical breakdown of Level I American Industry to obtain a graphic picture of the hierarchy of objectives proceeding from the simple to the more difficult skills for various individuals. For example, in the communication area there would be simple recall of the senses used in communicating without understanding how the senses were involved in communicating. The second level would include motor and verbal chaining in which the individual would draw the symbols used in communicating. He would also be able to link the names of the symbols with the actual symbols. This would make it possible to get the events in proper order. The lengths of the chains would vary with the individuals.

The third level involves multiple discrimination. In this level the individual would actually be applying conceptual reasoning. That is, after observing many concrete situations which

6/16/67 A TAXONOMICAL BREAKDOWN OF LEVEL I AMERICAN INDUSTRY O. Nelson
R. Gebhart

American Industry--Level I	Gagne' (1965)	Bloom (1965)	Psychomotor Domain
Solve Industrial Problems	-Problem Solving	-Through Level 6 Evaluation Through Level 5 Synthesis	
Interrelate Concepts	-Principle Learning		-General Procedure or Approach to Learning Manipulative Skills
Display a Conceptual Style of Reasoning; Apply Basic Concepts of Industry; Apply the Environmental Concepts	-Concept Learning	-Through Level 4 Analysis	
Identify Communication Acts (Other concept areas have been analyzed but are not shown on this chart)		-Through Level 3 Application	
Distinguish Between Two or More Different Symbols or Events	-Multiple Discrimination	-Through Level 2 Comprehension	
Identify Communication Symbols	-Chaining-Verbal	-Through Level 1 Knowledge	-Perform Specific Motor Skills (Taught to Individuals As Needed)
Draw Symbols	-Chaining-Motor		
Produce Labels For Communication Symbols	-S-R		

Some Beginning Competencies - Typical 8th Grade Students

1. Reading and Communication Skills
2. Mathematics Skills
3. Normal Psychomotor Development
4. Exposure to Local Enterprises
5. Experience in Handling and Spending Money
6. Etc.

Figure 5

demonstrate the way, ideas are transmitted from one individual to another, he would form a concept of communication, and could then apply this concept of communication to many other situations which were unique to him. The test would be for his conceptualization of communication for level three, and would assist him in applying other concepts identified as basic concepts of industry.

In the next level of principle learning the concepts are linked together to form simple principles. This means that the level of understanding and learning is getting more involved leading the student to the upper level of the taxonomy breakdown, that of problem solving. Problem solving involves:

A. Developing a plan of procedure for solving the problem.

B. Exercising judgments in determining what information is required in solving the problem.

C. The arranging of parts or information to form a logical pattern.

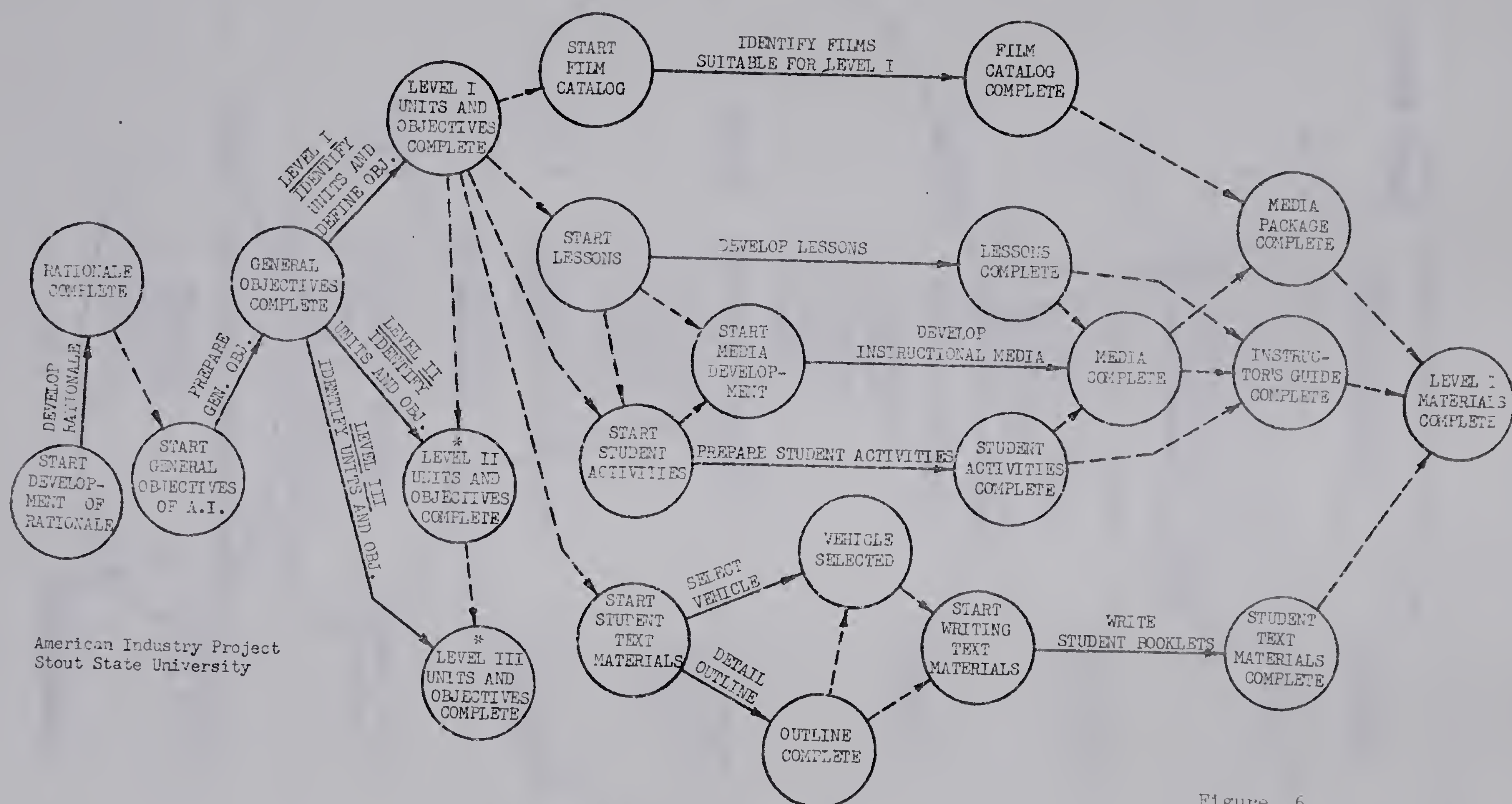
D. Discovery of new information.

(Gebhart, 1968i, pp. 14-15).

The Development of Level I Curriculum Materials. For further organization and development of content in relation to industry the American Industry Project Committee drew up a chart to illustrate the steps they wished to follow in the first level (Gebhart, 1968j, Figure 6, p. 17).

Keeping in mind the two objectives of this program the project committee developed all materials for the Amderican Industry courses. Then they identified the objectives as:

THE DEVELOPMENT OF LEVEL I CURRICULUM MATERIALS



American Industry Project
Stout State University

Figure 6

*These Activities Will Not Be Detailed In This Network.

R.G.

11/1/67

LEVEL I - AMERICAN INDUSTRY COURSE OUTLINE

TEACHER DIRECTED

	Units and Features	Unit Theme
Unit I	Industry Today 1. Introduction to American industry 2. Resources of industry 3. The environment of industry 4. The basic parts of industry	- Let's analyze industry.
Unit II	The Evolution of Industry 1. The needs of man 2. A search for greater productivity 3. Some effects of man's quest for productivity	- The needs of man and why he progressed.
Unit III	Organizing an Enterprise 1. Communication 2. Research 3. Management 4. Finance 5. Property 6. Energy	- Let's start a business.
Unit IV	Operating an Enterprise 1. Relationships 2. Procurement 3. Materials 4. Processes 5. Production	- Let's produce using modern production methods.
Unit V	Distributing Products and Services 1. Marketing 2. Transportation	- Why does a product sell?
Unit VI	The Future of Industry 1. State of the art 2. Reasons for change 3. Future expectations	- Where do we go from here?
Unit VII	The Students' Business Venture 1. Development 2. Fabrication 3. Marketing 4. Evaluation	- The students organize, produce, and sell.

STUDENT DIRECTED

Figure 7

> Level I, designed for eighth grade students, has the following objectives:
>
> 1. To develop a knowledge and understanding of the major concepts of industry and their relationships.
>
> 2. To develop the ability to solve simple problems related to industry.
>
> Level III, which is for twelfth grade students is designed to develop knowledges and problem solving skills within a concept area or cluster of concept areas appropriate to the individual's level of ability and interests (Gebhart, 1968k, p. 18).

Following this the course outlines were prepared in accordance with the objectives (general and level) and the conceptual method of presentation. The following is a brief outline of Level I and a diagram of the course outline of Level I (Gebhart, 1968l, Figures 6 and 7, pp. 17-18).

In preparing the objectives the Project study used the sequence as follows: (a) General American Industry objectives; (b) Level objectives; (c) Unit objectives and (d) Lesson objectives.

Level I was divided into units of study. It utilized the cyclical approach and was designed to "cycle" through the basic concepts of American Industry once in Unit I and then in Unit II. When the student progressed to units III, IV, and V, the individual concepts were studied in greater detail. Once the student had completed these three units he had studied each of the concepts and completed another cycle. As the student progressed, the level of understanding became more difficult. (Note as shown in Figure 4).

The structuring method that was used in the concept approach program involved moving from a teacher-directed activity

to a student-directed one. This meant that even though at the beginning of the course the activity was teacher-directed, it would gradually shift to the student. This provision was made so that the student would become involved in the in-depth problem solving that he needed to reach the higher levels of learning as shown in Figure 6.

Criterion No. 4: Provisions Made for Vocational Education and Career Preparation in Senior High School

The American Industry Project used the conceptual approach built around fourteen concepts. The Project found that one major difficulty facing industrial arts was the fragmented approach. In the past the emphasis had been on treatment of selected trades, occupations or material areas, and on developing the ability to perform specific operations, and did not provide for a study of industry. To provide for a study that would lead to industry, identification of concepts was begun.

Following the concepts, preliminary subconcepts were identified. For example:

> Under the major concept energy would be forms of energy, harnessing energy, storage and transmission of energy and using energy. Under forms of energy would be mechanical, chemical, thermal, electrical and atomic (Face and Flug, 1962b, p. 2).

They felt that this concept-centered method of teaching should benefit the student, the teacher and the employer. Teachers could cover broader areas of industrial activity from a wider perspective. The students would be able to comprehend areas of knowledge more quickly when they were pointed out as some part of a

larger whole that bore a resemblance to the world rather than the designed one that was found in most classrooms. The concept-centered method of teaching is suitable for both men and women, since it is basically general education and not vocational education.

The Project members also believed that to emphasize the learning of specific processes and techniques as an avenue to pre-vocational training had merit some fifty to sixty years ago. However, as new materials and processes were developed and industry evolved into its present complex form, this rationale was not now feasible.

The American Industry program offers a means of providing for <u>a smooth transition from general education to vocational education</u> in its acknowledgement of the need for all youth to have an understanding of American industry. The program provides for a solid foundation for all students, whether their future choice of vocations directs them into further technical study or into the professions. It is further believed that the understandings, if properly developed, should make it possible for the student to grasp, accept, and adapt to change as it is in actual life.

<u>Criterion No. 5: Activities Carried Out and Methodology Used</u>

Each lesson consisted of the following:

1. Theme (variation on the concept or principle involved).
2. <u>Behavioral objectives</u> which were developed according to the procedure defined in Figure 4, A Taxonomical Breakdown of Level I American Industry.
3. A general description, or scope, of the lesson.
4. <u>Resource references</u> identifying instructional media, and literature for students and teacher.

5. Lesson content which has been written in dialogue form addressed to the instructor. Lesson content consists of an introduction, activity and content, and a conclusion. In the lesson content, the resource reading, lesson activities, and instructional media have been appropriately keyed into that lesson.

6. Student activities are also a part of these lessons.

7. Evaluation items are included in each lesson; however, it has been suggested that the teacher use these only as a guide to preparing his own evaluation (Face and Flug, 1968h, pp. 21-22).

The same person who designed the activities also prepared the lessons. The activities became part of the lesson. It allowed the students to become involved in real industrially related learning situations. Some of the activities used in Level I included: planning for mass producing wooden coasters and silk screened pennants, going on field trips to observe natural resources or to visit an enterprise, posing labor-management problems and solving them through arbitration and establishing a small student enterprise.

Activities. The Project approach is one that through its activities is sampling American industry (Face and Flug, 1962c, pp. 6-7). The Project has broken away from the idea that industrial arts must give the student the idea of the working conditions of the hand laborer in industry. The Project stresses that the student must learn the significance of industrial relations to the laborer. By teaching the student the industrial relations, collective bargaining and other important elements of the industrial world he learns to integrate industry and classroom rather than separate them.

One of the activities is the television "Panel Program". In the panel program approach the students prepared for a panel discussion in which one member pretended to be a modern industrial worker; another pretended to be a worker for Henry Ford in 1915; another, an employee of Andrew Carnegie in 1880; and the fourth, an indentured worker on a 1670 Virginia plantation (Face and Flug, 1962d, p. 4).

Questions were put to each panel member. These questions concerned his employer's attitude toward competition, his concern about government regulation of industry, his (the employer's) concern for his employee's welfare, his attitude toward the public and its thoughts about his company.

Mass production is a reality in modern industry, but according to the Project studies, too little has been done in conventional industrial arts instruction to develop an understanding of it. To give students the understanding of mass production, they were asked to assemble parts for a fishing spinner along a regular assembly line. The line was allowed to produce for 12 minutes. In this period of time the classes turned out from 34 to 52 finished spinners.

Later a second period was used to assemble spinners manually. They were shown a model of the mass produced spinner. With this came the instructions to make as many spinners as possible in 12 minutes. Fewer than 10 were produced in each class during the 12 minutes.

The American Industry classes at the junior high school

competed with each other in the production of football novelty items (pennants, etc.) for a homecoming celebration. In a conventional industrial arts class the Project would have been content with manipulative activities, but the American Industry classes formed dummy corporations and ran the scale of industrial activity from incorporation to management to finance, procurement, research, production, advertising, and marketing. They had drawn this experience from their broader background gained from their previous class sessions.

The dummy corporations served as an exercise in the cooperative integration upon which American Industry relies for the efficiency which results in greater productivity.

General Operating Characteristics of the Course. It is important to have an understanding of the philosophy and rationale before attempting to teach American Industry courses (Face and Flug, 1968i, pp. 24-27). That is, the teacher must understand the guide and its division into units and lessons, the development of the concepts of American industry through the cyclical method, the aims of deeper understanding of the concepts, and the procedure of the studies of the concepts.

In using the guide and student texts, the teacher should always start by reviewing the introduction and course outline. This should follow by a study of the units, corresponding student activities, and student text materials.

Next, the teacher should study each unit, lesson by lesson, and detail his course in preparation for teaching it.

For further efficient operation of the course, the American Industry Project designed a system to gather feedback information from teachers and students.

Criterion No. 6: Grade Structure for Industrial Arts

The American Industry Project has three courses. The first consists of an overview of the nature of industry and how it operates. The second level course is to attain a more sophisticated understanding of the concepts of industry, and in the third course the students are given an opportunity to specialize in one or a related cluster of concepts.

Suggestions for the grade levels are:

> A suggested grade placement of these three courses is Level I in grade eight, Level II in grade ten, and Level III in grade twelve. This represents the grade levels for which the student materials are being prepared. However, several of the participating teachers are teaching Level I in the tenth and eleventh grades with success (Nelson, 1967a, p. 7).

Criterion No. 7: University Programs and Student Teaching Offered to Industrial Arts Students

Teacher Education. Due to inquiries from administrators, principals, and teachers about getting American Industry in their schools, the Project developed a teacher education program on the college level. The education of these teachers prepared them for the implementation of this new curriculum in secondary schools. This teacher education focuses its attention on four objectives.

1. The development of an understanding of industry.

2. The development of the ability to solve problems related to industry.

3. Professional competence as a teacher.

4. Personal competence as an individual and as a citizen (Face and Flug, 1965f, p. 2).

To attain these goals, the American Industry curriculum at the college level was developed incorporating four major aspects. They are:

1. A broad base of general and liberal studies.

2. Professional teacher preparation, normally beginning in the second semester of the freshman year and continuing through the first semester of the senior year.

3. Major studies of American Industry.

4. A substantial number of electives available.

The four aspects mentioned would be carried out over a period of four years. This would give the prospective American Industry teacher teaching experience and theory throughout the four years in college by means of the use of the teaching laboratory and professional seminar. The teaching laboratory would provide controlled, video-taped, and evaluated teaching experience with small groups of secondary school students. The professional seminar would provide the student with considerable knowledge and theory in various areas. The laboratory and seminar together would permit an integration of <u>theory</u> and <u>practice</u>.

<u>Courses Offered for Student Teachers for Classroom Instruction</u>. All courses offered have been developed (or are being developed) from the two general objectives of the Project.

<u>Criterion No. 8: Experimentation of Curriculum Material Before Curriculum Innovation</u>

<u>Feedback and Revision of Curriculum Materials</u>. Many of the

revisions came as a result of student and teacher feedback forms, classroom observation, teacher interviews, and student contacts. The Project's supervisor visited each school monthly. During these visits information was recorded pertaining to the instructional technique being used, instructional media employed, and the student's reaction to the presentation or activity. After each visitation the supervisor would discuss (with the participating teachers) the record that was prepared. During this time the additional suggestions for improving curriculum materials were often made (Nelson, 1967d, pp. 9-12).

For further feedback the feedback forms were used. One feedback form was completed by the teacher at the end of each lesson. In it was given an overall rating of the lesson and appraisal of the objectives, content, instructional media, plus other general comments. This method was used for rating each unit of instruction. The media feedback form was completed each time instructional media were used by the participating teacher.

The student reading material was rated by the students and the teacher. The student's part was to make comments within the booklets and underline words he didn't understand. If there was any lack of continuity the students were asked to note this as well. Finally, the students were also asked to complete a formal rating of each booklet (according to a special rating scale given them) that provided a sequence of information related to the students' attitudes toward the booklets, vocabulary, the style and layout of each booklet, readability of the booklets, and content. The teachers

assisted by examining each booklet to note spelling, punctuation, and technical errors. They would also check for literary continuity and suggest addition or deletion of material. This feedback information was recorded and filed by unit and lesson to be used for revision purposes. In making revisions each comment was reviewed and analyzed before making the final change.

For a further check on curriculum material before curriculum innovation, the Project group asked a consultant to evaluate the American Industry Project Development. To do this they obtained the descriptive data on the activities which emerged from the Project. These descriptive data provided feedback information which was seen as essential for making many of the decisions connected with the daily and long-term functioning of the Project.

The last question to settle was the source of data. There were three domains of data. They were entitled "ingredients", "processes", and "products".

"Ingredients" referred to all of the factors brought to the learning situation by the various agents involved. This pertained to resource books for the teachers, the teacher's guide, and the students' material. Another ingredient referred to was that of <u>characteristics</u> of the students. The abilities, interests, and knowledges have considerable influence on what is achieved. The nature of the teacher will play a vital role, and therefore, it forms another ingredient. The school and the community in which it functions will exercise considerable influence as well.

The "processes" domain surrounded the teaching acts, learning activities, and school organization forced on the ingredients for the purpose of achieving a set of objectives. This involved the students, teachers, and department heads.

"Products" formed the last domain for the evaluation. It embraced the complete outcomes of the study of American Industry. In this area the facets were student knowledges, understandings, skills, attitudes, and interests.

Evaluation of this type gave the Project group a picture of what the students liked or disliked, what should be deleted, or what should be added, what were the vocational behaviors of the students, and the reasons for their choices (Nelson, 1967e, p. 17). In 1970 the Project anticipates another follow-up study. At this time of special importance will be the career patterns of students in the evaluation.

Summary. From the American Industry program there was evidence that:

(a) their central purpose of education in industrial arts was "the development of the rational powers of man",

(b) to identify the structure of industry that was built around fourteen major concepts,

(c) to develop an understanding of those concepts directly applying to industry, and

(d) to develop the ability to solve problems related to industry.

Ohio State University Industrial Arts Curriculum Project

The Industrial Arts Curriculum Project personnel were concerned with industrial processes, materials, personnel and products, and became increasingly more aware of the widening gap between what is done in industry and how it is represented in school.

Criterion No. 1: Objectives

The Towers, Lux and Ray Industrial Arts Curriculum resulted from an effort of The Ohio State University in co-operation with the University of Illinois, sponsored by The Bureau of Research, U. S. Office of Education. The project built its objectives around the general educational aims for all schools. These educational aims were prepared by the National Committee of the Project on Instruction of the National Education Association and provided a setting for the objectives. To complete the setting, the purposes of industrial arts at all school levels were developed by the staff of the Industrial Arts Curriculum Project (IACP). The IACP was initiated in June, 1965, and is expected to continue until August, 1971. The Project Committee noted that the general aims or objectives provided over all direction, but were ineffective in communicating the detailed means and outcomes of education. For this reason the Project Committee listed five types of objectives (plus the IACP objectives); namely, the recommended objectives of education for all of the United States, objectives of education for a certain level, such as junior high school, objectives of industrial arts, objectives of the first year course of construction and the

second year course of manufacturing, and then the daily objectives of the whole course for all the year's work.

The objectives of industrial arts were general objectives applicable to all program levels in industrial arts from elementary school through collegiate and adult programs. These objectives were prepared by the staff of the IACP and were intended to direct development of programs designed to explain the content of knowledge of industrial technology.

These objectives were intended to cover the cognitive, affective, and psychomotor domains of educational objectives, and emphasize both mastery and transfer dimensions. The general industrial arts objectives read as follows:

> A study of industrial arts will enable pupils to:
>
> 1. understand the concepts, principles, generalizations, problems, and strategies of industrial technology,
>
> 2. have an interest in and an appreciation for industry as that element of the economic system that provides industrial material goods for the satisfaction of human wants for those goods,
>
> 3. demonstrate knowledge and skills that will be useful in life situations of occupational, recreational, consumer, and socio-cultural significance (Towers, Lux and Ray, 1966c, Attachment B, p. 4).

The fourth set of objectives were prepared for the first year course of instruction on construction.

> As a result of this course, the student will:
>
> 1. be aware of man's practices in industry that change the forms of materials to satisfy human wants for material products.

2. be aware of the historical significance of the construction phase of industry in society.

3. be aware of the concepts, principles, generalizations, problems, and strategies of construction technology.

4. be aware of the value management practices of planning, organizing and controlling as they relate to satisfying human wants through men and materials.

5. be able to comprehend the concepts of planning, organizing and controlling.

6. be able to analyze the interrelationships between planning, organizing and controlling.

7. be able to perform selected management practices in planning, organizing and controlling as they would relate to actual practice in the field of construction.

8. be able to perform selected production practices using tools and materials common to the construction industry.

9. develop understandings and appreciations through experiencing practices and applying knowledge to various real and simulated production situations in construction.

10. associate and discriminate between pre-processing, processing, and post processing practices used in one-the-site construction of a structure.

11. comprehend the universality of production practices as they relate to any structure.

12. gain knowledge, comprehend concepts, apply knowledge to production procedures, analyze production processes, synthesize production practices, and evaluate the results of production in various situations.

13. gain knowledge and appreciation of the practices of hiring, training, working, advancing, and retiring.

14. be able to identify, associate and discriminate between occupations in the construction industry.

15. gain experience in performing the practices of personnel relations.

16. be able to manipulate his knowledge and skills to investigate factors involved in community development of constructed works as they relate to an environmental setting.

17. gain appreciation and understanding of how man changes the forms of materials to satisfy human wants through construction by conceptualizing ideas, discovering principles, forming generalizations, solving problems, and determining strategies typical of construction technology (Towers, Lux and Ray, 1966d, Attachment B, p. 5).

The fifth set of objectives consisted of 170 sets of daily objectives: one set for every school day of the year. These sets consisted of from 1 to 14 objectives per day (Towers, Lux and Ray, Attachment B, 1966d, pp. 5-6).

A few examples of the daily objectives read as follows:

DAY 1

The student will be able to:

1. understand the purposes of industrial arts.

2. understand the purposes of the course.

3. make effective use of course material.

DAY 2

The student will be able to:

1. describe the hostile natural environment of early man and the need for environmental control.

2. describe some of man's primitive tools and their influence for his environment.

3. trace the gross evolution of the basic social institutions (Towers, Lux and Ray, 1966e, Attachment B, p. 3).

For its specific objectives by IACP, the IACP staff arrived at objectives by looking at industry. The project committee was concerned with industrial processes, materials, personnel, and products, but they as industrial arts educators had become increasingly aware of the widening breach between what is done in industry and how the industrial information is exhibited at school. It was their aim that the IACP should improve instruction related to industry as an institution within our society.

Objectives

> The objectives of the Industrial Arts Curriculum Project are to:
>
> 1. identify and structure that knowledge to be included in a study of industry.
> 2. prepare a program outline of selected elements of that knowledge - - industrial technology.
> 3. design and engineer an instructional system for teaching industrial technology in industrial arts.
> 4. improve the instructional system through field testing in selected industrial arts programs.
> 5. develop a program for the preparation of teachers (Towers, Lux and Ray, 1968a, Pamphlet, p. 2).

Criterion No. 2: Source of Content for Industrial Arts in Relation to Industry

The first two main objectives mentioned the "intent to identify and structure that knowledge to be included in a study of industry", and "to prepare a program outline of selected elements of that knowledge - - industrial technology".

The first task that lay before the Project staff was to separate industrial knowledge from all of man's knowledge. The

Committee structured this knowledge and named it Industrial Technology. Industrial Technology provided a source of subject matter for Industrial Arts.

Industrial technology is the knowledge utilized to satisfy man's wants for industrial material benefit. The Committee found that man uses this knowledge in two essential activities: that of construction and that of manufacturing. To provide for an understanding of these industrial differences, the Project staff allowed for two courses for junior high school students. The first course was "The World of Construction", and the second course was "The World of Manufacturing". Both courses were to serve as a guide in the conceptualization of a more adequate structure of framework for the organized study of industry. The results of these studies were to lead in the organization and development of the content of the course for the schools themselves.

Criterion No. 3: Organization and Development of Content

The source, organization and development of content (Criteria 2 and 3) are interwoven in the IACP. As a consequence, some of the findings overlap.

In the IACP Attachment A (Towers, Lux and Ray, Attachment A, 1966a, pp. 1-106) the authors have presented the way in which their project was undertaken. The Project Committee undertook the systematic development of a structure for the body of knowledge from which industrial arts content could logically be derived. The Project Committee stated:

> If this total effort is successful, industrial arts as a curriculum area will have a cohesive, comprehensive, and internally consistent framework from which students can draw meaningful insight into that complex and productive societal enterprise - - modern industry. The benefits of such insights in terms of enlightened citizenship, educational-occupational guidance and integration with the culture and the world of work would indeed be substantial (Towers, Lux and Ray, 1966b, Attachment A, p. vi).

To develop the IACP Project more fully and clearly, the Project Committee structured the body of knowledge into logical divisions or realms of knowledge.

From the various classes of theory, the Project Committee proposed four domains of man's knowledge. There were: (1) descriptive knowledge, (2) prescriptive knowledge, (3) praxiological knowledge, and (4) formal knowledge (Towers, Lux and Ray, Attachment A, 1966c, pp. 7-11).

The key term for the descriptive knowledge would be sciences, since the sciences seek and establish facts about manifestations and events and describe their interrelation. The prescriptive knowledge would be the fine arts and humanities that seek to provide man with a system (or systems) of values. The praxiological knowledge is described as the knowledge of practice. It is represented in higher education by the various professional schools and departments like medicine, education, journalism, law and others. Praxiology is man's way of doing that which brings about through efficient action what is valued or ought to be valued. The disciplines within formal knowledge serve

as tools which are utilized to order all knowledge and therefore could be refined out as the arrangement of the other three. For example, mathematics and logic could be recognized for these purposes by institutions of higher learning (Towers, Lux and Ray, Attachment A, 1966d, pp. 12-23).

The Project wanted to conceptualize a structure of industry as a basis for content in industrial arts. In order to do this, it was first necessary to investigate the nature of the major divisions of man's knowledge to establish the need for a study of man's total practices (praxiology). Then, praxiology had to be structured insofar as it relates to the problem of structuring industrial praxiology. To place this problem in its proper view relative to this Project, they reviewed the status of industrial arts. In this review the Project Committee questioned the need for industrial arts, its influence in the past, industrial arts definitions, and whether industry should be the source for industrial arts curriculum.

From these and other questions the Project organized and developed their first draft of instructional materials to be used in a junior high school course titled "The World of Construction", semester one and two. The Project also had drafts of "The World of Manufacturing", which was primarily concerned with developing an understanding of how the manufacturing managed production system produced and serviced manufactured goods.

For further study the Project made an analysis of content structure of contemporary national curriculum projects, examined

the content structures utilized, and reviewed materials developed by at least twenty curriculum projects (Towers, Lux and Ray, Attachment A, 1966d, p. 140). By these examinations the Project found that content modification largely followed two paths. One was that of changes that reflect a non-traditional way of looking at the other, changes that reflect the procedures used by professional workers in the related disciplines.

From the various analyses of contemporary curricula, the IACP found that some activities concentrated on educational methodology, others had undertaken to restructure the subject matter.

For analytical purposes the Project focused on the dominant role of a societal institution, keeping in mind that all roles of mankind are closely interlaced to form the total cultural structure.

The IACP adopted the analytical approach for its study of industrial technology. The Project realized that industry's principal role is that of organizing resources and of considerably changing the form so that it produces the material goods required to satisfy man's wants. This does not mean that this is the only function of industry, for it has a commitment to other major societal purposes (Towers, Lux and Ray, Attachment A, 1966e, p. 148).

The IACP analysis commenced with the identification of industry as a sub-element of the economic institution. Figure 8 (Towers, Lux and Ray, Attachment A, 1966f, p. 151) presents an example which is usually applicable to all sub-elements of the

Figure 8

A PARADIGM OF THE ECONOMIC INSTITUTION

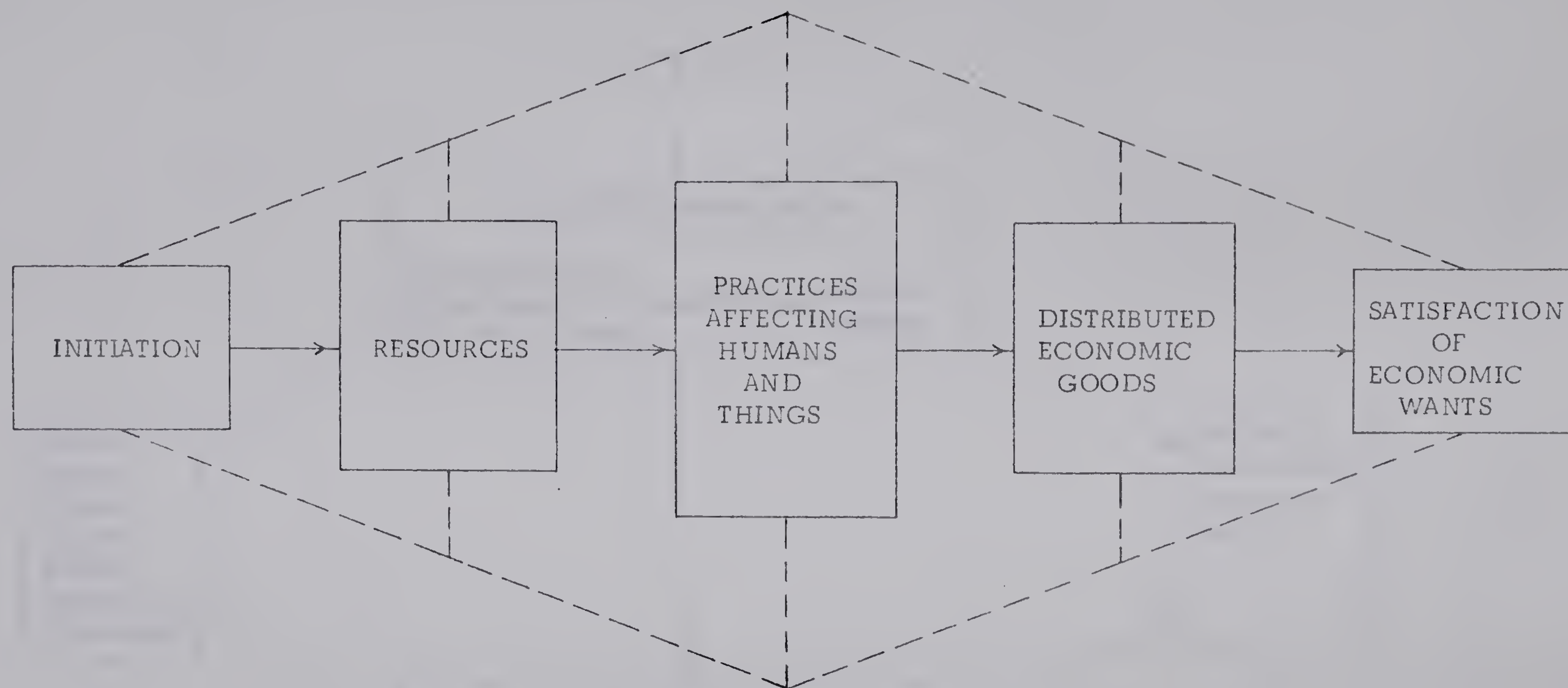


Figure 9

MAJOR GROUPS OF PRACTICES IN THE ECONOMIC INSTITUTION

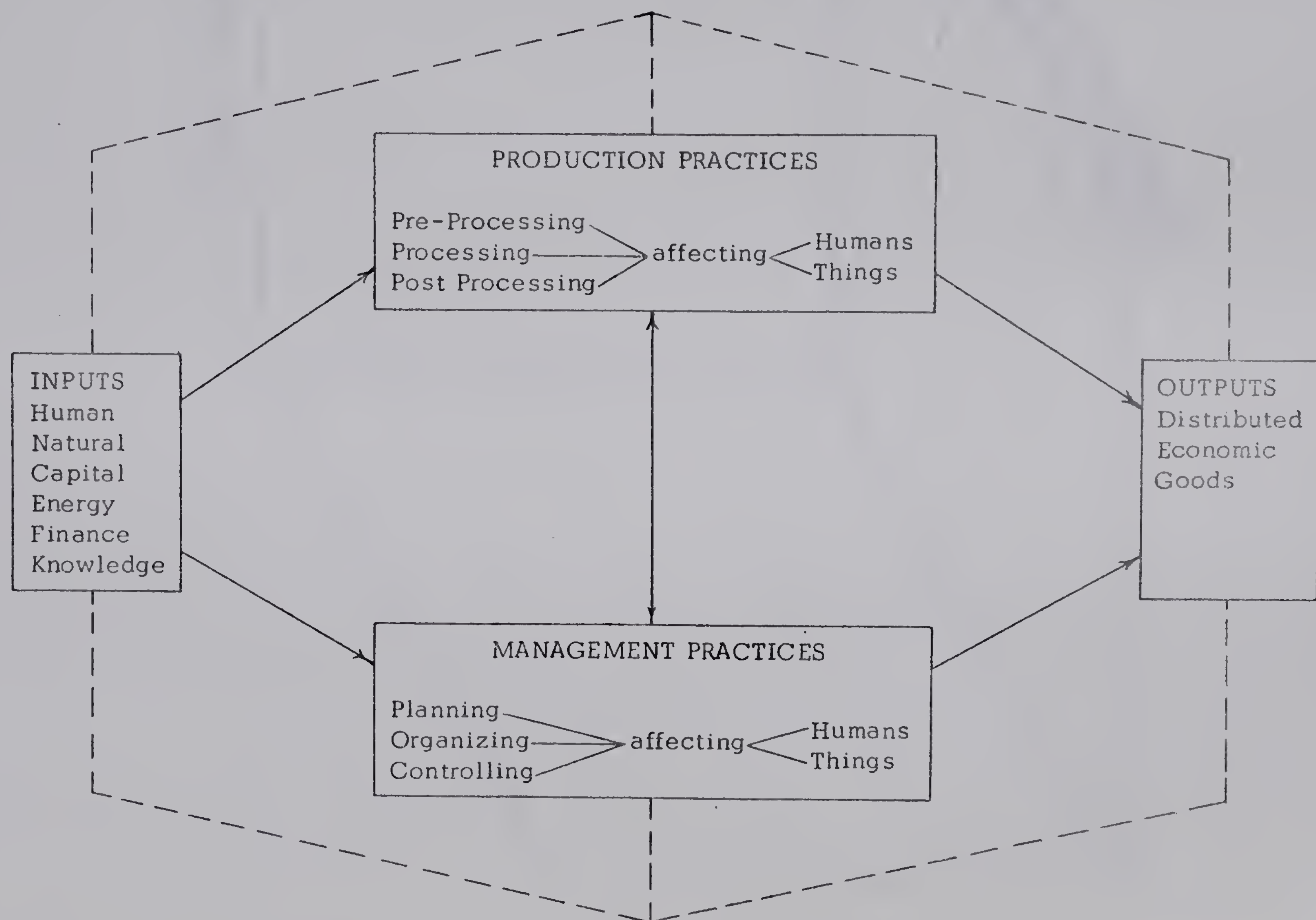


Figure 10

A FIRST ORDER MATRIX
OF THE TECHNOLOGY OF THE ECONOMIC INSTITUTION

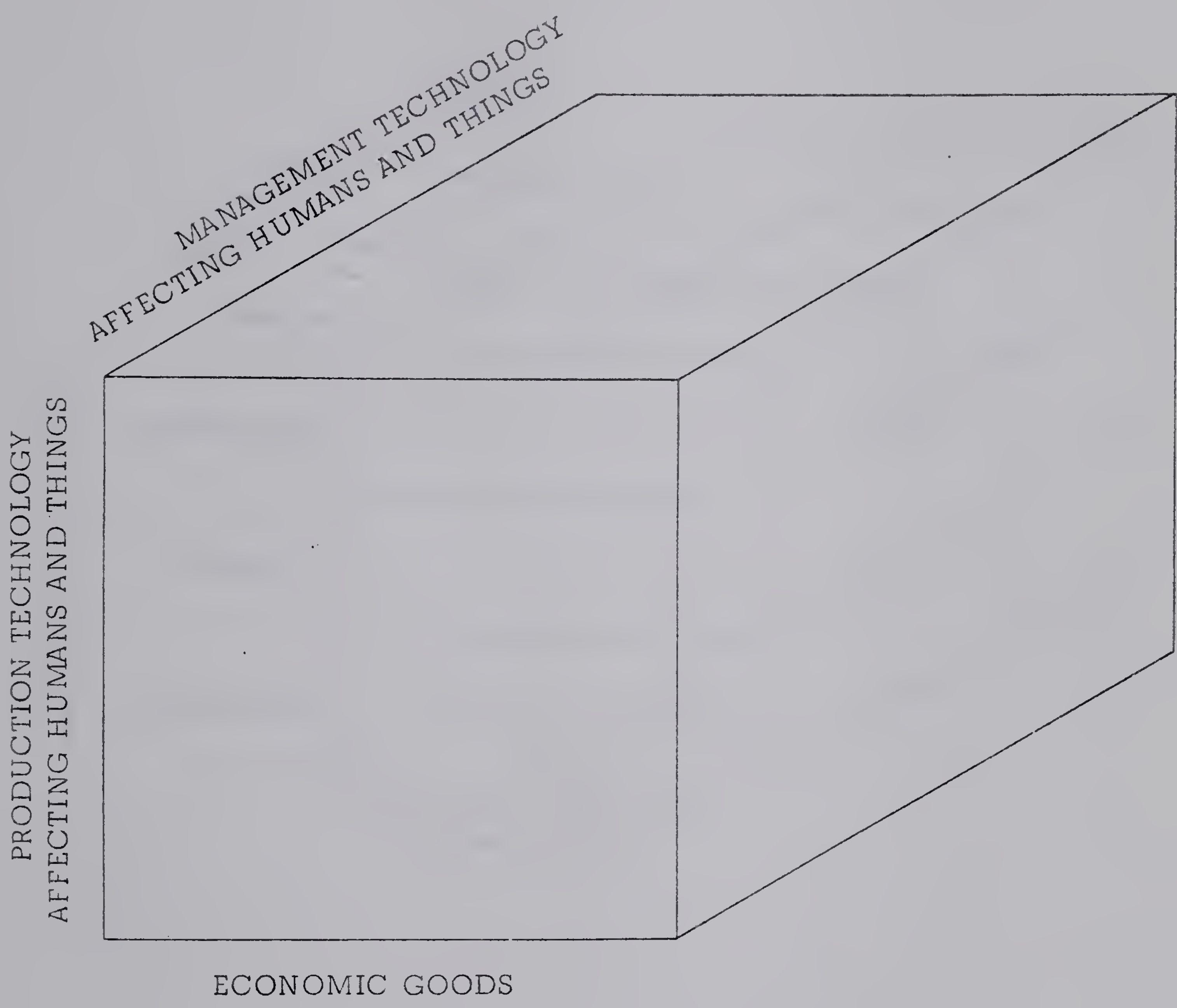
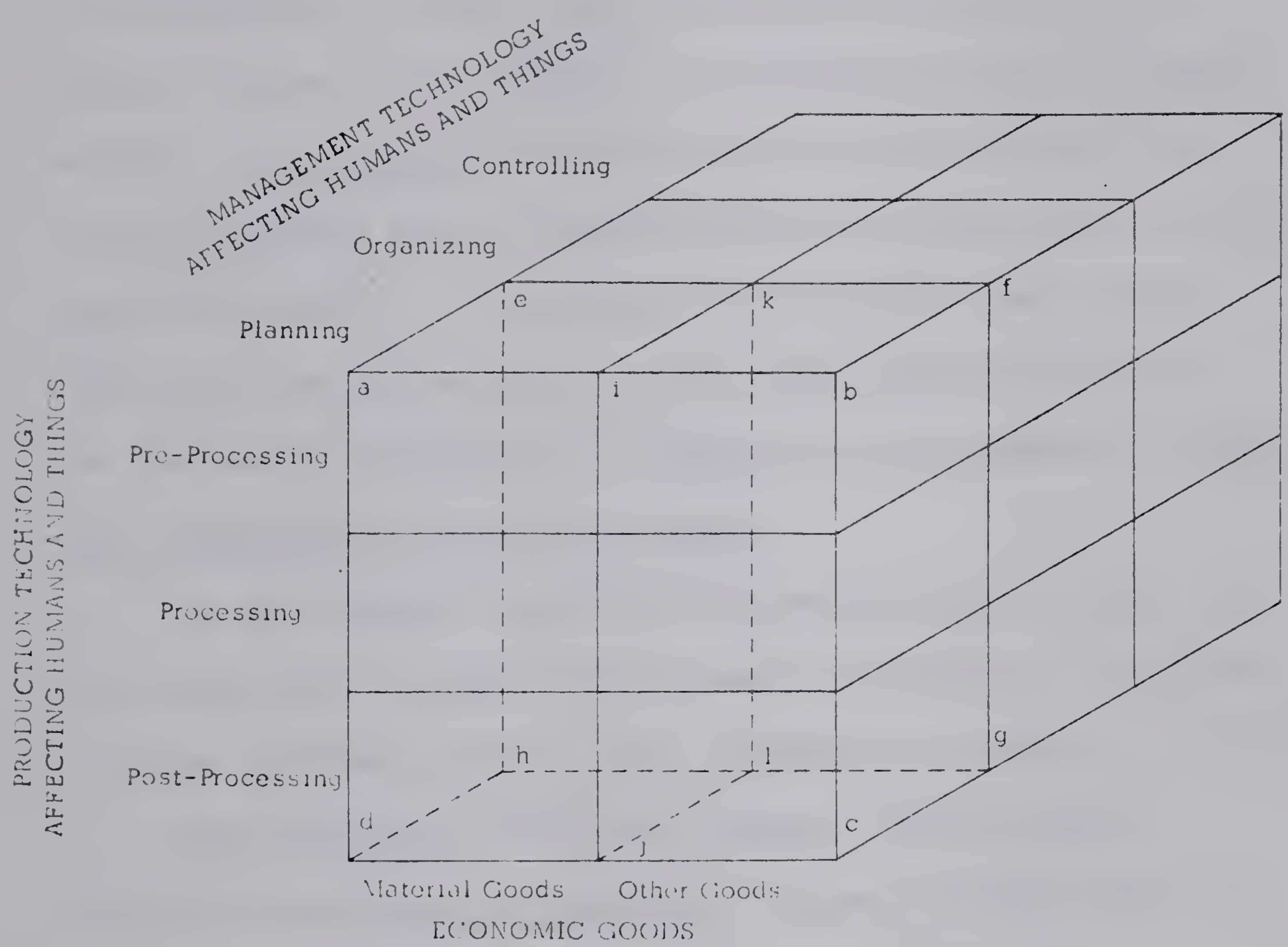


Figure 11

A SECOND ORDER MATRIX
OF THE TECHNOLOGY OF THE ECONOMIC INSTITUTION



economic institution and shows the complete sequence. Note that the cycle commenced with an act of introduction (or initiation) in which a human want or need is identified or foreseen. That is, resources consist of energy, natural, human, finance, capital (tools and facilities), and knowledge is selected as inputs to the productive system. These resources are processed in harmony with practices suitable to the specific field of economic activity. The outputs of this productive system are the distributed economic goods, containing added structure, place, assets, and/or time benefit. To complete this continum, these distributed goods are the methods by which human wants are satisfied. The feedback is represented (as depicted in the diagram) by broken lines connecting all the major stages.

In the economic institution are major groups of practices which exist only to affect either humans or things as is depicted in Figure 9 (Towers, Lux and Ray, Attachment A, 1966g, pp. 148-154).

The knowledge of efficient economic practices may be referred to as economic technology. One way of visualizing the interrelationships within economic technology is by means of three-dimensional matrices. Examples are given in Figures 10 and 11 (Towers, Lux and Ray, Attachment A, 1966 h, pp. 155-156).

By using the matrix approach an analysis provides a unique way of looking at the multiple dimensions of this body of knowledge. Even though the primary responsibility of IACP was directed toward industrial arts at the junior high school level,

Figure 12

FIRST ORDER MATRIX OF INDUSTRIAL TECHNOLOGY

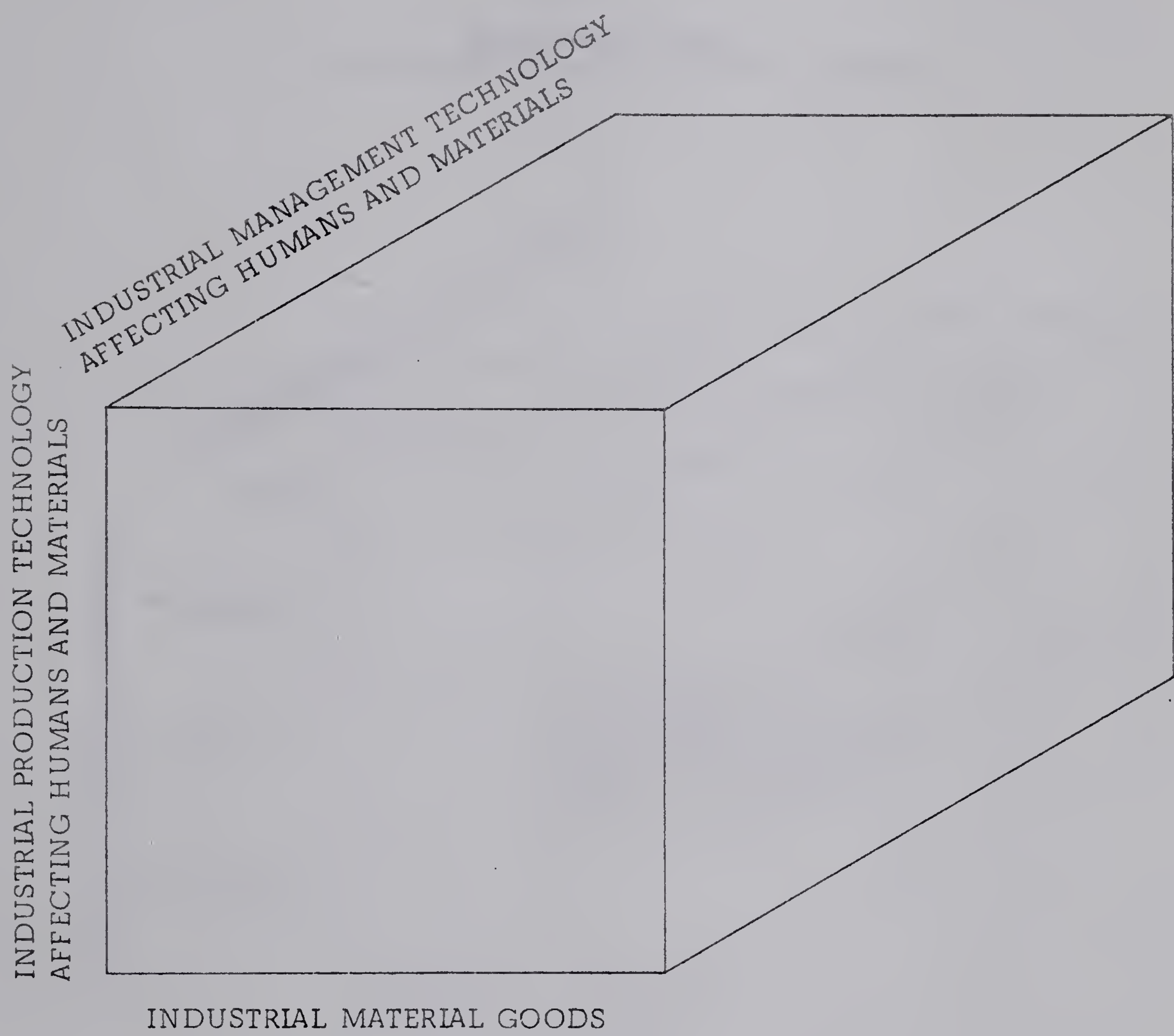


Figure 13

SECOND ORDER MATRIX
OF INDUSTRIAL TECHNOLOGY AFFECTING MATERIALS

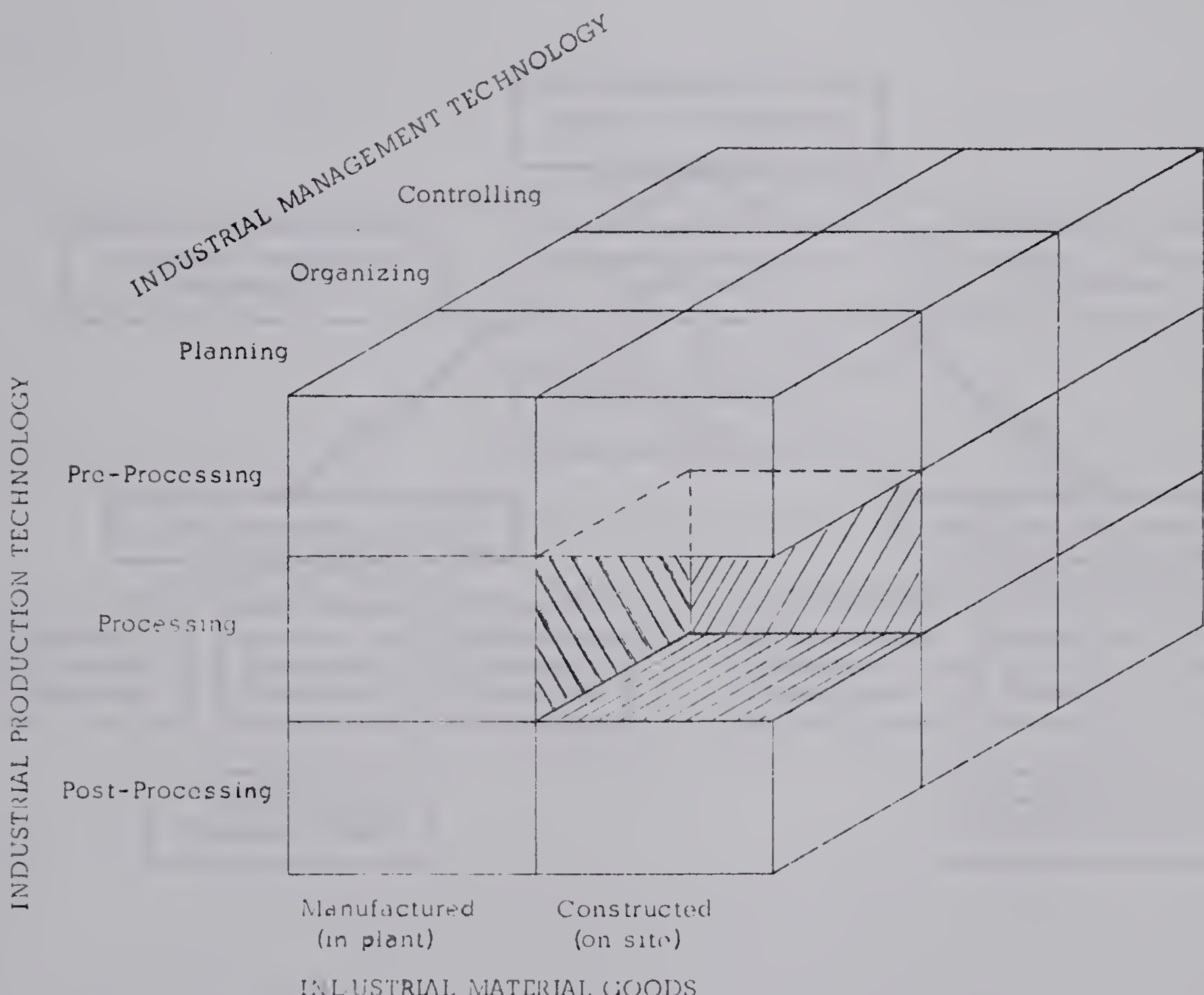
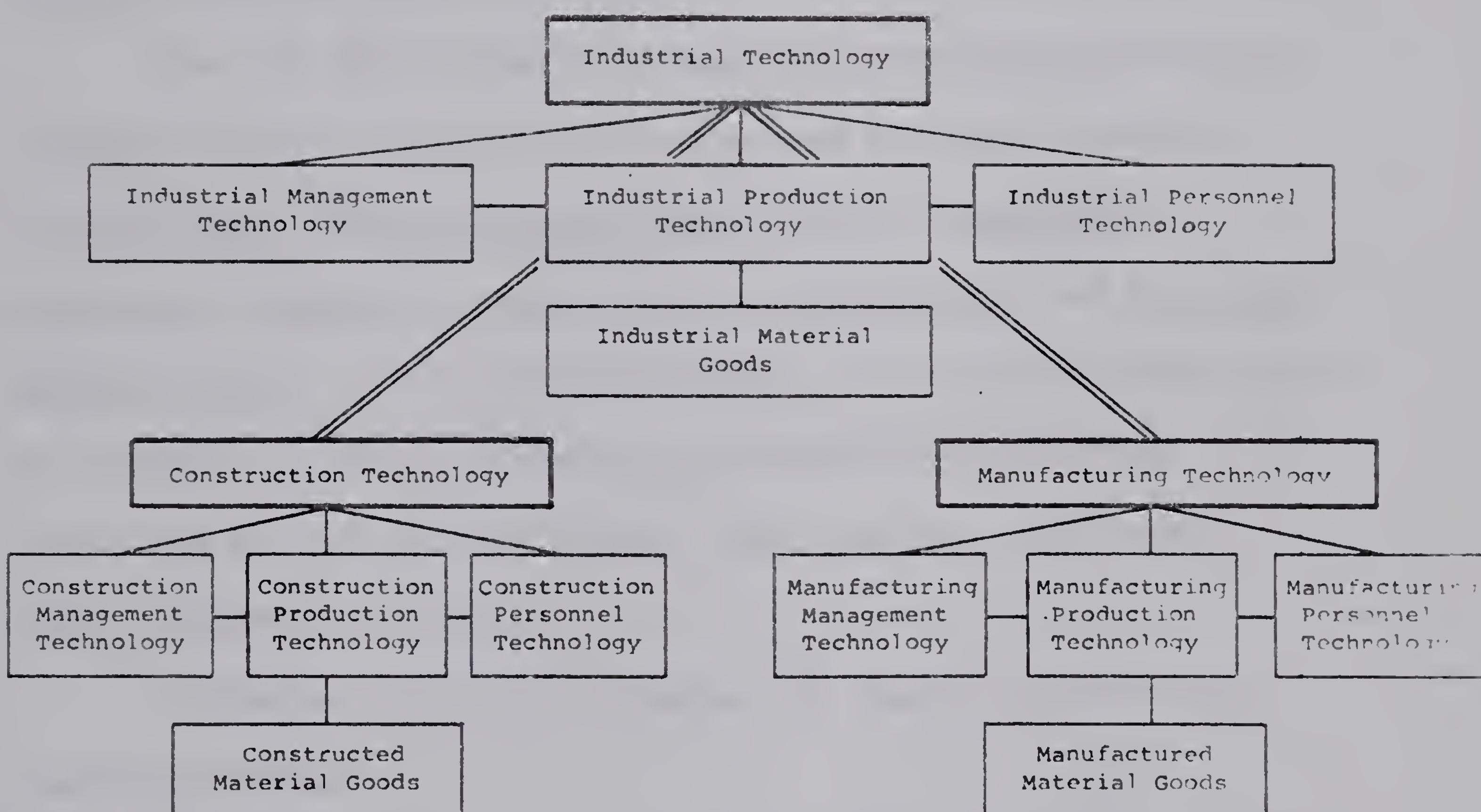


Figure 14

MAJOR STRUCTURAL ELEMENTS
IN INDUSTRIAL TECHNOLOGY



the matrix of industrial technology (as shown in the matrix Figures 12 and 13) has potential applicability at all grade levels (Towers, Lux and Ray, Attachment A, 1966i, pp. 58-159).

The matrix did not assume that the Generalized model of Industrial Technology presented was to be taken as the ultimate structure for the body of knowledge from which industrial arts subject matter was to be selected, but it represented the most advanced and most promising conceptual construct that the Project staff was able to devise.

From the structuring of Industrial Technology the Project proceeded to the details of that structure into the studies of six different industrial technologies; namely, management, production, personnel, construction, manufacturing, and industrial material goods. The interrelationships of the various technologies in relation to the major structural elements in industrial technology are outlined in (Towers, Lux, and Ray, Attachment A, 1966j, Figure 14, p. 158).

To further select and organize the learning experiences the Project stated:

> Contemporary curriculum improvement projects appear to follow a somewhat common developmental pattern of (1) identifying and structuring the body of knowledge that will serve as the source of course content, (2) stating general objectives, (3) writing textbooks, (4) developing a series of exciting learning experiences, (5) building measuring devices to determine if appropriate learnings were mastered, and (6) training the teachers. (Towers, Lux and Ray, Attachment A, 1966k, p. 234).

The IACP was committed to the belief that a structured body of knowledge peculiar to the industry does exist, and this body of

knowledge was termed industrial technology. The Project staff took the position that this body of knowledge should serve as the major source of content for industrial arts. It also influenced the IACP in the selection of the objectives, learning experiences, and course materials.

The only course material available Industrial Technology I was, "The World of Construction", as found in Attachment D (Towers, Lux and Ray, Attachment D, 1966a). The content of this Attachment D is divided into six units consisting of separate assignments for each of the 170 school days of the school year. An example of Unit I follows:

UNIT I	MAN REMAKES HIS WORLD
Day 1	Introduction . . . .
Day 2	Tools and Society . . . .
Day 3	Producing Economic Goods . . . .
Day 4	Industry in the Economic System . . . .
Day 5	The Technology of Industry . . . .
Day 6	Story of Construction . . . .
Day 7	Major Construction Practices . . . .
Day 8	The Creation of a Building . . . .
Day 9	A Masterpiece of Construction, "The Dam" . . .
Day 10	The Construction Field . . . .

(Towers, Lux and Ray, Attachment D, 1966b, p. 111).

Briefly, Unit I, Man Remakes His World, is to make the student aware of (1) man's practices in industry in changing the forms of materials to satisfy human wants for material products, (2) the historical significance of the construction industry in society, and (3) the concepts, principles, generalizations, problems, and strategies of construction technology.

Unit II, that of Management in Construction, is to make the

student aware of (1) how to manage, plan, organize, and control men and materials to satisfy human wants, (2) how to perform selected management practices in planning, organizing, and controlling men and materials in the field of construction, (3) how to gain knowledge, comprehend concepts, apply knowledge to management practices, analyze management procedures, synthesize management processes, and evaluates the effects of management upon given situations.

Unit III, Production in Construction, teaches the student how to (1) perform selected construction practice using tools and materials common to the construction industry, (2) develop understandings and appreciations through experiencing practices and applying knowledge to various real and simulated situations, (3) associate and discriminate between practices used in on-the-site construction of a structure, and (4) gain knowledge, comprehend concepts, apply knowledge to production procedures, analyze production processes, synthesize production practices, and evaluate the results of production in various situations.

Unit IV, Working in the Construction Phase of Industry, is to assist the Student in (1) gaining knowledge and appreciation of the practices of hiring, training, working, advancing, and retiring, (2) developing skills to identify, associate and discriminate between occupations in the construction industry, and (3) gaining experience in performing the practices of personnel relations.

Unit V, Community Development, assists the student in factors involved in regional development of constructed works as they

relate to an environmental setting.

Unit VI, A Construction Project assists the student in gaining appreciation and understanding of how man changes the forms of materials to satisfy human wants. This can be done by conceptualizing ideas, discovering principles, forming generalizations, solving problems, and determining strategies typical of construction technology (Towers, Lux and Ray, Attachment D, 1966c, pp. i-ii).

It is important to note that with these units of study the student is given the purposes of industrial arts studies; that is:

1. Understand the concepts, principles, generalizations, problems, and strategies of industrial technology;

2. Have an interest in and an appreciation for industry as that element of the economic system that provides industrial material goods for the satisfaction of human wants for those goods;

3. Demonstrate knowledge and skills that will be useful in life situations of occupational, recreational, consumer, and socio-cultural significance. (Towers, Lux and Ray, Attachment D, 1966d, p. 1).

The one-year junior high school course, The World of <u>Construction</u>, gives every student an opportunity to study and use the knowledge and skills which men use in the construction industry. Students study a set of progressional practices common to building of any structure, whether it is a bridge, dam, road, building, tower, or tunnel.

First the construction practices are conceptualized. Then they are performed by the students to increase their understanding of how men produce and service the constructed projects around them.

The central focus of the course is technology.

The World of Manufacturing assists in answering questions like: How does a company manufacture a transistor radio? How are the parts made? How is the radio put together? Where do the materials come from? Who works in manufacturing?

The students will have the opportunity to use tools and materials to produce some simple products that are representative in principle of all of man's products produced in a factory or plant. He will also learn about the elements of the technologies that unite men, machines, and materials into operative systems. The technologies to be studied are the management, production, and personnel dimensions of manufacturing (Towers, Lux and Ray, 1968a, p. 6).

Criterion No. 4: Provision Made for Vocational Education and Career preparation in Junior and Senior High School

Only the junior high schools are dealt with in this program. Some mention is made of occupational goals. The Project proposes:

> Industrial arts is a study of industry. It is an essential part of the education of all students in order that they may better understand their industrial environment and make wise decisions affecting their occupational goals. (Towers, Lux, Ray, Attachment A, 1966h, p. 2).

Or: . . . .

> In today's rapidly changing world of work, the key saleable skills are flexibility and adaptability. An educational program based solely on the formal, descriptive, and prescriptive disciplines may not provide the necessary knowledges and skills for entry

> into the labor market. On the other hand, a secondary school program _geared to isolated occupational practices which may be obsolete within a few years is remarkably inefficient._ (Towers, Lux and Ray, Attachment A, 1966i, p. 21).

In the _Guidance Information_ curriculum bulletin (Towers, Lux and Ray, 1968b, p. 1) that was developed for the guidance counselors, there is further information regarding occupational emphasis. The Project committee indicated that for years industrial arts teachers have been saying that one of the important reasons students should study industrial arts is for its guidance value. The exploratory activities in the various shops with a variety of tools and materials gave the boys an opportunity to experiment and gain first-hand experience in different work-oriented enterprises. This furnished boys with occupational information and technical skills, although on a small scale, to see where they might fit in occupationally.

No comment can be made regarding vocational education and career preparations from the IACP information, since this information was not available.

Criterion No. 5: Activities Carried Out and Methodology Used

Learning Experiences in "The World of Construction". The learning experiences were grouped according to types of activities and did not reflect the sequence in which they were learned or the quantity of activities. A list of activities that was given provided a cross-section of what the student would do in class. In addition to this the student would read about "The World of Construction", solve problems in a workbook, listen to teacher

presentations, watch films and demonstrations, and discuss problems and concepts with other class members (Towers, Lux and Ray, 1968d, p. 4).

The laboratory activities allow for performance in:

1. Surveying topography.
2. Mapping topography.
3. Designing structures.
4. Sketching alternate solutions.
5. Sketching plans, elevations, section of structures.
6. Sketching wiring, heating and cooling, plumbing plans.
7. Sketching plot and foundation plans.
8. Sketching details.
9. Working specifications.
10. Estimating.
11. Scheduling construction.
12. Establishing efficient way to clear sites, move earth.
13. Setting grade stakes, batter board, lines.
14. Building wood forms.
15. Setting steel reinforcement.
16. Receiving, placing, finishing concrete.
17. Laying blocks.
18. Rigging, placing, assembling, plumbing steel frames.
19. Laying out, sawing, assembling, plumbing wood frames.
20. Sheathing, siding, roofing.
21. Laying brick.
22. Installing electrical wiring.
23. Installing plumbing systems.
24. Installing sheet metal ventilating systems.
25. Installing insulation.
26. Applying drywall.
27. Plastering.
28. Laying floor tile.
29. Installing acoustical
30. Installing paneling.
31. Glazing.
32. Painting.
33. Fitting moldings and tinwork.
34. Installing gutter and drainspouts.
35. Demolishing and salvaging wood frame structures.
36. Repairing, altering, maintaining structures.
37. Planning, contracting, building a model house.

Playing games related to:

1. Bidding on construction jobs.
2. The construction managed-production system.
3. City and regional planning.

Experiments in:

1. Efficiency with tools, techniques, personnel and materials.
2. Analyzing soils and effects upon structures.
3. Correlating foundation design with soil types.
4. Planting grass and plants.
5. Stabilizing undercut foundations of buildings.

Classroom Activities. Role playing in:

1. Bidding.
2. Contracting
3. Hiring personnel.
4. Setting working conditions.
5. Solving grievances.
6. Mediating and arbitrating.
7. Striking.
8. Title closing.
9. Decision making in planning and developing a community in terms of: utilities, industries, flood control, streets, and highways, schools, central business districts, shipping centres, high and low density housing, and recreational facilities.

Group participation in:

1. Selecting construction sites based on predetermined criteria.
2. Filling in legal documents, e.g. offer to purchase, contracts, deeds, mortgages.
3. Examining career patterns in construction industries.
4. Setting up class organization for construction.
5. Solving labor-management grievances.

(Towers, Lux and Ray, 1968e, pp. 4-6).

Learning Experiences in "The World of Manufacturing". Listed below is a series of representative activities planned for the laboratory and classroom. In addition to these activities the students have periodic assignments in a textbook and workbook.

Among the laboratory activities are:

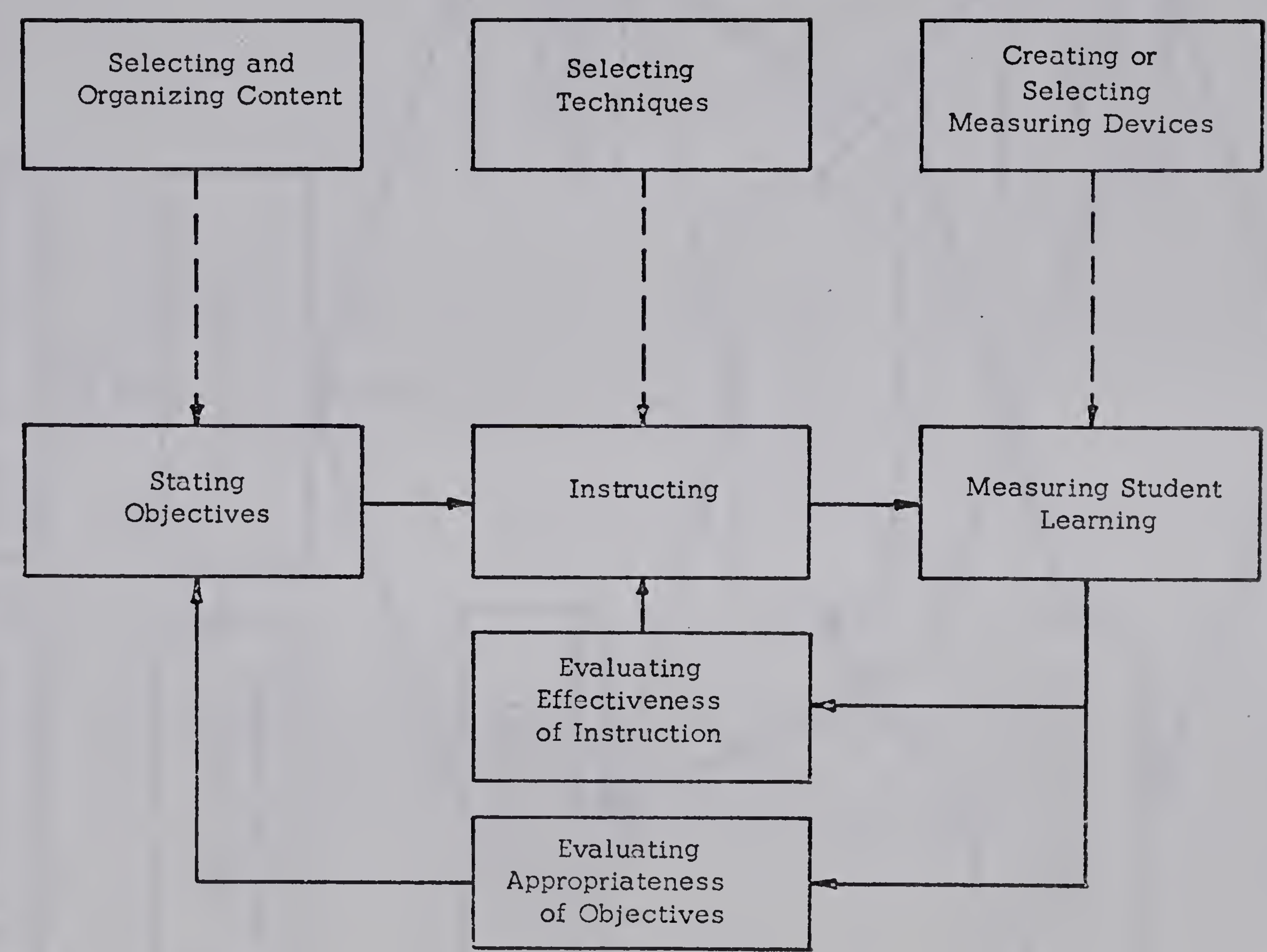
Making market analyses.
Experimenting with properties of materials.
Retrieving data.
Punching data cards.
Sketching.
Model making.
Presenting product designs to top management.
Making working drawings.
Building prototypes.
Writing specifications.
Estimating costs.
Making time and motion studies.
Building jigs and fixtures.
Preparting raw materials.
Making industrial "standard stock".
Making component parts.
Assembling parts into products.
Cutting.
Forming powdered metals.
Casting.
Heat treating.
Alloying.
Blending.
Electroplating.
Painting.
Printing.
Anodizing.
Inspecting.
Protecting.
Packaging.
Writing warranties.
Using service manuals.
Repairing products.
Mass producing several products using many of the above practices.
Role playing employer-employee situations.

Such a study extends and reinforces other subjects of school. It provides a learning-by-doing atmosphere. At the conclusion of the course, pupils will have a rather sophisticated understanding of the system that produces our manufactured goods. Pupils should be able to describe the basic steps that must be taken to produce any product in their environment (Towers, Lux and Ray, 1968f, pp. 6-7).

The two models in Figures 15 and 16 (Towers, Lux and Ray, 19661, pp. 287-288) illustrate the means of general methodological

Figure 15

TEACHING PROCESS MODEL
(Adapted from Hough and Amidon, 1966)



INSTRUCTIONAL MODEL

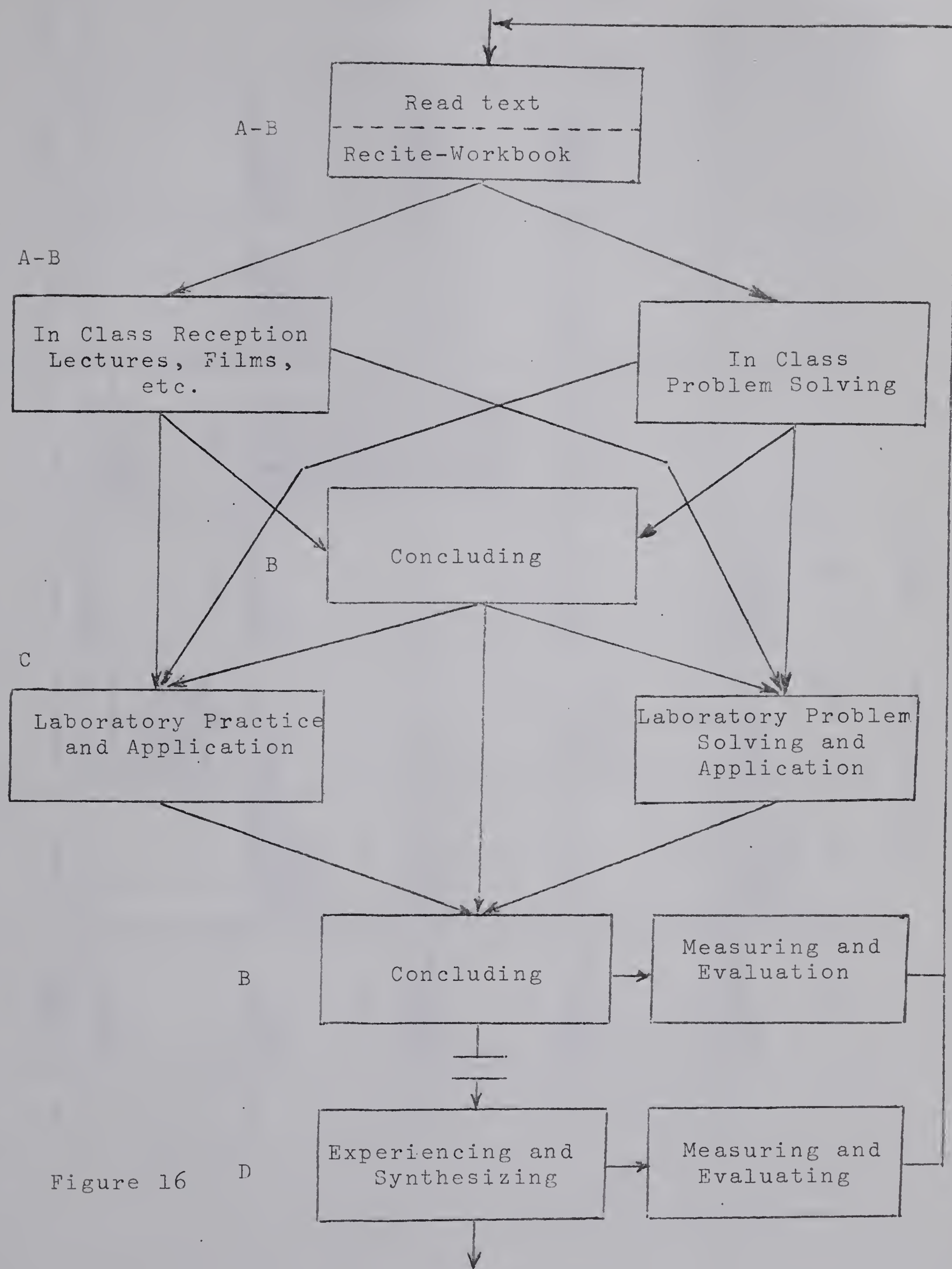


Figure 16

DAY	READING ASSIGNMENT	WORKBOOK	PRESENTATION	DISCUSSION	STUDENT ACTIVITY	LAB. [illegible]	DISCUSSION	EVALUATION
1	Preface to the Student		Lecture: 1. Purposes of Ind. Arts 2. Purposes of first year course in construction 3. How to use course materials (25)	Student questions (10)	Receives course materials (e.g. text and laboratory manual) (10)			
2	Tools and Society (35)	1. Study questions 2. Identify examples of contemporary environmental control (15)	Film: Tools and Society (20)	1. Student questions 2. Film (5)	Comparison of human energy expended without tools or simple machines and human energy expended with them. Pulley - Lever Wheel and shaft Block and tackle (10)	Record comparative force expended with and without tools or simple machines (5)	1. Interpretation of results 2. Application (5)	
3	Producing Economic Goods (30)	1. Study questions 2. Classify economic goods (15)	Lecture: Producing economic goods (10)	Student questions (5)	Comparison of electric drill, hand drill, and bow drill to illustrate efficiency in producing industrial material goods (2[illegible])	1. Record comparative times 2. Formula for man's material welfare (5)	Efficiency and the formula for man's material welfare (5)	
4	Industry in the Economic System (30)	Study questions (15)	Lecture: Industry in the Economic System (10)	Student questions (5)	Analysis of input-output system of constructed project (20)	Record elements of the system (5)	Review system and its elements (5)	
5	The Technology of Industry (30)	1. Study questions 2. Interview person employed in an industrial organization (20)	Film: The Technology of Industry (30)	1. Film 2. Student Report of Interviews (15)				

Daily Time Table Figure 17

tactics of the Industrial Arts Curriculum Project. The first figure describes the over-all teaching process. There are three phases evidenced: planning, teaching, and evaluationg, with two feedback loops. One loop is designed to influence the selection of objectives and the other is to influence the selection of learning activities. When the instructional model is broken down, it becomes another model of the general daily tactic used by the IACP as shown in (Towers, Lux and Ray, 1966m, Attachment A, p. 287). The instructional model consists of the types of learning activities that will generally occur in a day's time or for a particular principle or concept. It involves several main procedures on the part of students: reception, selection, problem-solving, application, synthesis and evaluation.

These models and processes represent the hypotheses that were generated by the staff of the Industrial Arts Curriculum Project to describe the way in which the objectives could best be met (Towers, Lux and Ray, Attachment A, 1966n, pp. 286-298).

Criterion No. 6: Grade Structure for Industrial Arts

The IACP has arranged for the junior high school only as is evidenced by the following quotations.

> To provide an understanding of these industrial divisions, the first course for junior high school students is "The World of Construction", and the second course is "The World of Manufacturing" (Towers, Lux and Ray, Pamphlet, 1968c, p. 2).

> Thus, while the primary responsibility of the Industrial Arts Curriculum Project is directed toward industrial arts at the junior high school level, . . . (Towers, Lux and Ray, 1966j, p. 163).

> The immediate concern of the Industrial Arts Curriculum Project is to develop a two-year articulated program for the junior high school years. A conscious attempt must be made to base curricular decisions upon a sound rationale. (Towers, Lux and Ray, 1966k, p. 234).

Criterion No. 7: University Programs and Student Teaching Offered to University Industrial Arts Students (Ohio State Bulletin, 1966-67, p. A-69)

> Industrial Arts Education. The curricula in industrial arts education has been designed for teachers in secondary, college and adult programs. The comprehensive major requires the completion of 80 credit hours, and meets the requirements of the Ohio Four-Year Provisional High School certificate validated for the teaching of industrial arts in junior and senior high schools. Students desiring to pursue this program should consult with the area adviser.

Nine hours of student teaching in industrial arts is required in the professional courses at the Ohio State University.

Criterion No. 8: Experimentation of Curriculum Material

As was mentioned in Criterion No. 2, the IACP consisted of two courses: (1) "The World of Construction" and (2) a study of "The World of Manufacturing".

The IACP has completed its first draft of instructional materials to be used in a junior high school course titled, "The World of Construction" semester one and two. This instructional program is being field tested at the present time. Drafts for "The World of Manufacturing" (a second year course) are now being developed and should be ready for the beginning of the fall school term of 1968.

Summary

The structure of the IACP was based on the assumption that industrial technology is knowledge used to satisfy man's wants for industrial material goods. They further found that man uses this knowledge in the two principal activities of construction and manufacturing. On these two activities the IACP based their industrial arts program for the junior high school grades.

Donald Maley chose for his program "an individual-centered approach, with the scientific method of problem solving being the principal element" (Status of Research in Industrial Arts, 1966a, p. 51). Maley further stated:

> The pursuit of the problem by the student involves the development of a scientific approach to the object of his curiosity. He learns and practices the techniques of research. He uses the language of research - - - statements of problems, hypotheses, assumptions, variables, findings, and conclusions (Status of Research in Industrial Arts, 1966b, p. 52).

The research and experimentation program was mostly concerned with "how to learn" rather than with "what to learn", the latter being the makeup of the traditional educational program. The significance of the program was not that of learning subject matter as such but on learning research procedures. This made the individual student completely responsible for the selection of subject matter.

Criterion No. 1: Objectives

From the idea of learning by research procedures came the goals (or objectives) for the program as follows:

1. To develop an appreciation of the scientific approach to problem solving.

2. To develop a fuller understanding in the area of industrial research.

3. To offer a meaningful program to teach tools, processes, and materials.

4. To stimulate pupil interest in high-level laboratory activities.

5. To provide exploratory experiences of value for the student in his selection of avocational as well as vocational or professional pursuits.

6. To develop the student with respect to satisfying his own curiosity and developing self-reliance and the ability to do critical and analytical thinking.

7. To increase the individual's understanding and abilities in the area of consumer activities.

8. To develop in the student a feeling of creativity and satisfaction (Status of Research in Industrial Arts, 1966c, p. 52).

Livingston, in his ninth-grade research and experimentation program, gave the main purpose of the course as "producing the thinking student". It was felt that the primary goal was accomplished by correlating the various academic subjects and industrial arts in a practical learning condition, the research project.

Criterion No. 2: Source of Content for Industrial Arts in Relation to Industry

In Maley's Program, the area of study was maintained within the framework of the following definition.

> Industrial Arts as a curriculum area is defined as those phases of general education which deal with industry - - its organization, materials, occupations, processes and products -- and with the problems resulting from the industrial and technological nature of society (Maley, Mimeograph No. 1a, p. 3).

The definition identifies certain broad areas which continue to have special pertinence to the broad study of industry. These studies include the organization, materials, occupations, processes, products, and problems of industrial

THE JUNIOR HIGH SCHOOL PROGRAM

IN

INDUSTRIAL ARTS

Developed by

The Industrial Education Department

of the University of Maryland

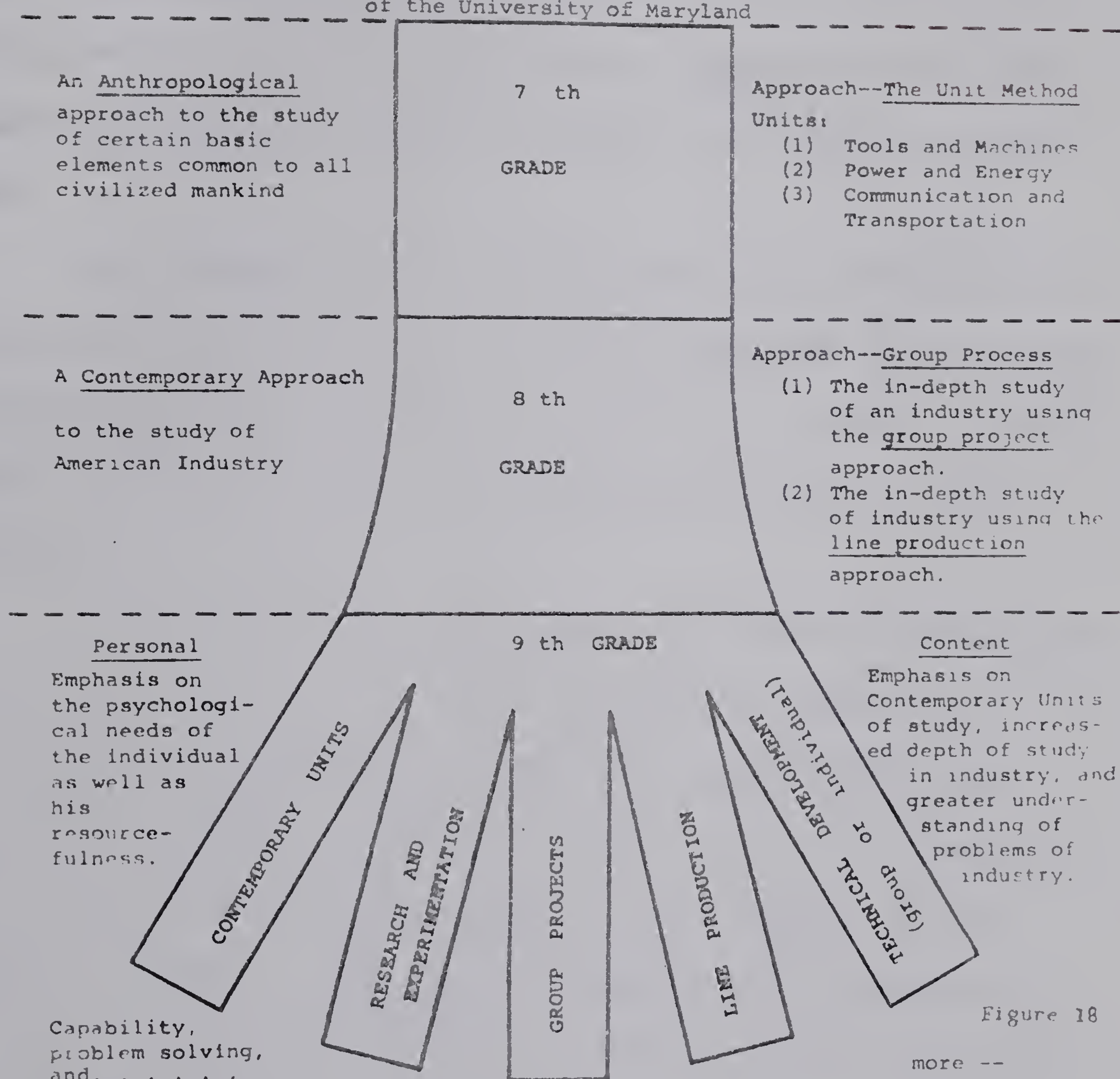


Figure 18

society.

To study these facets the Maley Program took the group project approach to the study of a major industry and the line production experience that widened from the various levels of personnel organization and finance through "procurement, planning, production, distribution, and dividends".

The second emphasis was placed on the principal function of Industrial Arts as the development of people and not things; that is, the people in industry, and not the things that people make.

Maley suggested that educators draw their information for industrial arts studies not only from contemporary industry, but from subject areas of the school, since it was considered impossible to study any discipline or subject within itself (Maley, Mimeograph No. 1, p. 11).

Maley emphasized that to obtain this first-hand information about what industry was to offer, experimental laboratories were needed for industrial arts education that offered those learning experiences which assisted boys and girls to understand the industrial and technical aspects of life today. In this laboratory method of teaching and acquainting the student with industry, the subjects of algebra, geometry, science, and others would be meaningful to the student.

To follow the Program, and understand it more fully, refer to Figure 18 (Maley, Mimeograph No. 1b, p. 17).

Criterion No. 3: Organization and Development of Content

In the organization and development of the content for the Program, Maley stressed that Industrial Arts cannot fulfill the needs of the great democratic-technological society with one single approach. In order for industrial arts to be a partner in a program of modern education, it must not continue in its narrow, limited approach to learning. Maley said:

> For the record it is appropriate to say that our activities at the University of Maryland have centered around numerous approaches to Industrial Arts content. We have attained wide recognition for significant contributions in the areas of the group processes, the unit approach to content organization, and procedures that more nearly simulate those in modern industry (Maley, Mimeograph, 1961a, pp. 1-2).

In establishing bases for industrial arts content, Maley felt it was imperative that three basic elements were considered with more than the usual lip-service treatment.

1. The content of Industrial Arts must be oriented in the context of the society in which it functions - - the sociological base.

2. The content of Industrial Arts must be built upon principles of human understanding and a knowledge of the growth and behavior of people - - the psychological base.

3. Dr. Walter Waetjen in a series of lectures on Industrial Arts content and method had pointed out the existence of biological bases for what is done in the industrial arts laboratories. Such elements include the concepts of right dominance, left dominance and mixed dominance with regard to physical activity and the biological factors influencing motivation and exploration (Maley, Mimeograph, 1961b, pp. 2-3.

Within the just-mentioned broad bases, Maley considered a unique series of bases for the "Research and Experimentation"

approach to teaching industrial arts.

First, he believed that any program carried out in a public school should have as its center of focus the development of people. This meant that the emphasis on display case filling, take-home projects, prizes and contests, would have been departed from, and the emphasis put on people rather than on things.

Second, Maley believed in industrial arts as a phase of general education, in which he envisioned the program of industrial arts as a study of the problems, products, and processes of industry as well as the occupations and contributions of those engaged in industry. He advised a serious attempt should be made to implement a program of education devoted to the interpretation of modern industry.

Third, it was believed that one single process (a way of performing a task) of industrial arts was not to be the same for all since it could not satisfy the various individuals. The industrial arts program was to be so organized that it would not be directly related to manipulative skills, since not all pupils have equal skills. By having stressed the manipulative skills in the past, many students who should have been in the Industrial Arts program had never received the benefit of Industrial Arts.

Fourth, with the emphasis on research and development in modern industry, the "Research and Experimentation Program" would assist greatly in acquainting the pupil with what actually does take place in industry.

A fifth emphasis was placed on problem solving and on sound decision-making. Maley believed that in the research and experimentation program, problem solving was very important.

The sixth base was the concept that science is a very important aspect of industry, its operation, and its interpretation. In fact, Maley emphasized that "science is welded to industry and the development of new products and processes through research will continue to shape the industrial pattern" (Maley, Mimeograph, 1961c, p.).

The seventh base was derived from the field of human growth and behavior. As the students were observed in the various laboratories the motivational characteristics were noted within the individual as well as the groups. Further, it was found that the program of research and experimentation provided endless opportunities for the students to pursue the causal relations among many of the objects, processes, and situations found in a highly industrialized society.

All seven bases mentioned were incorporated into the planning of the "research and experimentation" programs. A conscious attempt was made to put into effect understandings in the fields of sociology, psychology, and biology (Maley, 1961d, pp. 3-17).

After operating the research program on the seven bases for three years, Maley said:

> It is considered a program geared to an understanding of the nature and needs of a society, a faith in the

> capabilities of boys and girls, and a faith in Industrial Arts as a very important part of the total school program (Maley, 1961e, p. 17).

Criterion No. 4: Provision Made for Vocational Education and Career Preparation in Junior and Senior High School

In the junior high school program the Maley Program allowed for exploratory experiences of value for the student in his selection of avocational as well as vocational or professional pursuits (Status of Research in Industrial Arts, 1966d, p. 52). To assist the students in these pursuits an investigation was conducted (with it came a development) of a cluster concept that could be used as a program in vocational education at the secondary school level by the industrial Education Department of the University of Maryland.

The research involved the identification of tasks which were required for entry into the occupations found in the Construction Cluster. These tasks were then classified into two categories.

> Level I - - Those tasks which are needed immediately upon job entry.
>
> Level II - Those tasks which are not needed immediately for job entry into an occupation, but will be needed soon after entering the occupation (Maley, 1965-66a, p. iii).

The cluster concept is a program aimed at the development of skills and understandings related to a group of occupations within the construction cluster. This did not mean an in-depth detailed development into any one occupation, but an attempt at

preparing students to enter a range of occupations within this construction cluster.

Need for the Course. The course was designed to meet the needs of those students following a general curriculum in the secondary school system by providing job entry skills in a few of the related subjects. It was further intended to meet the student's need for self-appraisal of interests and potentialities in a number of occupations. Specific needs include the following:

1. To provide students with the opportunity for a greater degree of mobility on a geographical basis.

2. To provide students with the opportunity for mobility within an industry or occupation.

3. To provide students with the opportunity for greater flexibility in occupational choice patterns.

4. To develop students who will be adaptable to technological changes (Maley, 1965-66b, p. 132).

Course Objectives. The course for the construction cluster will be directed toward the following objectives:

1. To broaden the stuent's knowledge of the available opportunities in occupations found in the construction cluster.

2. To develop job entry skills and knowledge for several occupations found in the construction cluster.

3. To develop safe habits and a favorable attitude toward work in the construction cluster.

4. To develop a student's insight into the sources of information that will be helpful to him as he moves through the occupational areas (Maley, 1965-66c, p. 132).

The specific objectives for the course cluster concept approach were the following:

1. To develop the student's competency in the use of common hand tools found in the construction cluster.

2. To develop the student's competency in using power tools and equipment needed for job entry into the occupations found in the construction cluster.

3. To develop the student's understanding of the operations, procedures, and processes associated with the construction cluster.

4. To develop safe working habits related to the occupations within the construction cluster.

5. To familiarize the student with the terminology associated with the construction cluster.

6. To develop an understanding of the resources available to him in his pursuit of course as well as in his work following graduation (Maley, 1965-66d, pp. 132-133).

Criterion No. 5: Activities Carried Out and Methodology Used

Maley pointed out that the purpose of the individual centered approach program was to produce the thinking student, through the correlation of such subjects as mathematics, science, English, and industrial arts into a practical learning situation. He further pointed out that by involving the student in research lay the secret of success of the program. Maley believed that by assigning work that satisfied and interested the student, he could readily learn the processes needed to accomplish his goal (Status of Research in Industrial Arts, 1966e, p. 53).

This signified that the focus of attention in methodology was on what the individual did, and more specifically, how he did.

The method used to correlate the various subjects was:

1. English: The library is used extensively to obtain ideas and background information.

2. English: Businesslike correspondence is carried on between students, industry, government organizations, etc.

3. Mathematics: In most projects practical mathematics is involved, whether mathematical, electrical, or chemical research is done.

4. Science: All projects involve one or more of the sciences, such as physics, chemistry, biology, botany.

5. Industrial Arts: All research projects require planning, correlation, and construction of working models, full-sized projects, and test equipment. All are handled by the industrial arts department.

6. English: The recordings of processes, progress and findings of research projects (Status of Research in Industrial Arts, 1966f, p. 53).

Since modern industry was considered a product of science and technology, all the activities of industrial arts were centered around the testing, analysis, and investigation of tools, materials, and processes. The Program activities were not the traditional industrial arts "making and building" type idea with the end being some material item to take home. It involved the "making" aspect, but the making was now carried to the end of developing experimental instruments and the pursuit of product, too, material, or process analysis, testing, or development.

Maley based his philosophy of activities on: "We need to be builders of man rather than inspectors of projects". The industrial arts program of industry and technology had industry with its many aspects for its subject matter, but it was mainly concerned

with the development of people. This signified that industry was the subject matter area, but the development of people was the end product. This included the people from all walks of life, no matter what profession (Maley, Mimeograph, 1953a, pp. 3-5).

The laboratory in which the students were to study and engage in the activities of industry was to consist of an environment of a composite of planning tables, library facilities, testing and discussion area, machines, tools, materials, benches, projection, and associated instructional facilities. But the facilities alone were not sufficient. The problem was how to make the greatest use of the facilities toward an educational program geared to the present and not obstructed by tradition. This required well planned activities.

To get a more vivid picture of the actual activities, an example was used of the Carpentry Experiences of Level I (Construction Cluster) for the grade 7 students.

UNIT I

Title: Fabrication and Erection of Supporting Wood Structural Units in House Construction.

Objective: To develop in the individual the capability for erecting columns and girders, box sills, floor joists and bridging according to tolerances specified by the job.

Manual or Manipulative Learning:

A. Laying out square and bevel cuts with a framing square to an accuracy of 1/16 of an inch.

Verbal Learning:

Communication:

A. Reading a blueprint to determine size, type, location of framing members and hardware.

Measurement:

A. Measuring with a steel tape or folding rule to an accuracy of 1/16 of an inch.

Mathematics:

A. Adding, subtracting, multiplying, dividing in order to economically cut stock to correct length.

Science:

A. Explaining span limits of structural members.

Suggested Student Activities

All students activities should be made as practical and meaningful as possible. The erection of full-scale or model units may assist in this process.

A. Nailing up a built-up girder.

As the manual learning varied, so did the verbal learning and the activities that went with it. Yet, all the activities were so planned that they assured the student of an experience that was meaningful and practical (Maley, 1965-66e, pp. 138-139).

Criterion No. 6: Grade Structure for Industrial Arts

The Maley Program was designed for grades 7, 8 and 9. Maley was convinced that the research and experimentation activities in industrial arts could be carried out effectively at the secondary level. Therefore, the early planning, discussing and promoting of the experimentation concept could be the ideal place for the senior high school academic student to be permitted to apply the principles of mathematics, mechanics, and science in testing,

analysis, and experimentation. All these principles involve tools, materials, processes and products (Maley, Mimeograph, 1959a, p. 8).

The seventh-grade program was based upon an anthropological approach to a study of certain basic elements common to all civilized mankind. In this approach the unit-seminar-contract-project approach was used. The units were as follows:

1. The Development of Tools and Machines and their contribution to the Growth of Civilization.

2. The Development of Power and Energy and Their Contributions to the Growth of Civilization.

3. The Development of Communications and Transportation and Their Contributions to the Growth of Civilization (Maley, Mimeograph No. 2a, p. 5).

The units (as described in Criterion No. 5) were established for the seventh grade program, and each student selected his particular project and sub-topic that would contribute to the total unit topic. Each student was required to do his own research, investigation, planning, construction, and presentation. The seminar setting was used in the presentations. Each student was also encouraged to explore on his own, use whatever resources were at his disposal, and write whatever he found he could contribute to the unit topic.

The eighth grade program was designed to be an approach to the study of contemporary American Industry. It used the group project and line production techniques of teaching the group process approach. The approach involved an in-depth study of modern industry in which the approach was aimed at studying an industry using a project-industry as an industry-organization format.

The project-industry organizational make-up was used only from an organizational point of view, but the industries studied could be steel, paper making, aluminum, copper, coal, oil, and others.

The end product from the construction activity was a project of greater size, difficulty, and skill. In addition to the large projects there were additional products produced by the students in the pursuit of their function on the personnel organization plan.

Further, the students organized into a functional line and staff personnel plan consisting of positions as project director, research director, personnel director, design engineer, and many more. The industry procedure provided them with information and experience as it was believed to be done in industry.

Another form of group methodology used for eighth grade students was the line production technique. This afforded them an opportunity to study the actual volume production as is done in industry.

The eighth grade study of contemporary industry was intended to assist the student in developing concepts related to the broader aspects of the subject such as:

> Concepts related to the organization of industry, productivity, occupational opportunities, mechanization, automation and cybernetics, labor-management relations, financial structure of industry, and concepts related to the changing role of the individual in industry (Maley, Mimeograph No. 2b, pp. 7-9).

The ninth grade program was based upon a concept of the location of the ninth grade in the 6-3-3 school plan as well as the

developmental tasks that went with that age and grade level. The program was aimed at a different level of individuals as well as a different level of study.

The content for grade nine centered basically around contemporary units of study and increasing the depth of study in industry.

Further, it included the research and experimentation program as another possibility for student activity. This program approach was an attempt to put into practice what the best educational psychology and practice seemed to support. In this program the individual-centered approach was the principal element. The traditional lecture method of teaching was discontinued giving the student the opportunity for research.

In general, the program "focused on an experimental-laboratory-for-people concept" (Maley, Mimeograph no. 2c, pp. 11-13).

<u>Criterion No. 7: University Programs and Student Teaching Offered to University Industrial Arts Students</u>

Maley challenged the teacher education institutions to produce teachers who were capable of designing learning experiences rather than placing the predominant emphasis on "project design" (Maley, Mimeograph No. 1, p. 15).

In the early 50's the College Park, Maryland, Institute permitted an in-depth teacher-education experience to prepare teachers for a student-centered approach of teaching industrial arts in the junior high schools. The institute dealt with three important

aspects of teacher education as it related to such a program in industrial arts. They were: (Maley, NDEA Summer Institute, Mimeograph, p. 37):

1. The identification and development of content for the specific areas to be covered.

2. The identification and the development of specific methodology appropriate for each of the phases of the program.

3. Actual laboratory practice in each of the methods to be used. This also provided meaningful and functional settings for the development of content in each of the phases of the seventh and eighth grade programs (Maley, NDEA Summer Institute, Mimeograph, p. 37).

It enabled the institute to accomplish an integrated teacher-education experience where content development, methodology, and actual practice were combined.

The objectives of the institute were to develop industrial arts teachers with the capabilities as follows:

a. To carry out penetrating and in-depth studies with junior high school students in the facets of industry and technology involved in the program.

b. To effectively carry out unit studies of an anthropological nature dealing with the elements of tools and machines, transportation and communications, and power.

c. To effectively carry out an in-depth study of industry using the group project approach.

d. To effectively carry out an in-depth study of mass production industries using the line production approach.

e. To effectively use and guide the learner (junior high school) in the use of the resources of the community in such a study of industry or technological developments.

f. To carry out learning experiences with students which involve an effective integration of economics, anthropology, history, industry, science, mathematics, and technology (Maley, NDEA Summer Institute, Mimeograph, p. 37).

The institute had further objectives to prepare these prospective industrial arts teachers. They wished to strengthen the participant's knowledge about technological developments, about industry - - its processes, products, problems, organization, and contributions - - and to provide the participants with a realistic approach to bridging the gap between theory and practice, content and methodology, learning theory and laboratory experiences.

It was hoped that by having provided the teachers with this information they would now have the necessary stimulation and security to attempt the implmentation of such a program in their schools or laboratories.

The whole institute was operated on the basis of the actual program as described in Criterion No. 6 of the Industry and Technology Program. Two weeks were spent in each of the three units. Every teacher received a six-weeks training period to get involved in the anthropological approach of the seventh grade, the contemporary approach of industry for the eighth grade, and the personal (psychological emphasis. These three approaches would assure the teachers of experience in the program and content development, identifying and developing methodology, and the actual activities to be carried out by the pupils (Maley, NDEA Summer Institute, Mimeograph, p. 39).

Criterion No. 8: Experimentation of Curriculum Material Before Curriculum Innovation

The first development of the Industry and Technology Program began at the University of Maryland in 1952, and was introduced into public schools in 1959 (Maley, Mimeograph No. 2d, p. 10).

In 1959, through the joint efforts of the University of Maryland the Montgomery County (Maryland) School System, a class in experiments in Industrial Arts was instituted at Montgomery Hills Junior High School. The pupils identified their class as the Industrial Arts Research Laboratory. It was an elective class.

The group involved were at the ninth grade level (all male), with a considerable range in intelligence scores. They met for one hour of actual laboratory classes every day of the school week. The planning, purchasing, and developing of the experiments extended beyond the limits of the one-hour period a day. A general shop was used for all forms of instructional procedures, equipped with a library and planning center, a student assembly area, and adequate storage facilities. Each student was provided with a special place for his research project. All students in the class took part in the planning, recording data, listening to reports on findings, and discussions of procedures. The whole experiment was a vitalized student-centered program dealing with industry, its activities and components.

As a result of the study and records that were made, it was

hoped that insight would be gained into changes to be made for the future. It was realized that better insights into motivational procedures, class organization, pupil selection, experiment selection, laboratory equipment, and program development could be attained (Maley, Mimeograph, 1953b, pp. 8-9).

Further studies in attempting to interpret modern industry were made in the study of the oil industry, power generation, ceramics, transportation, and textiles. Each industry studied included a penetration in depth, so that an intelligent decision could be reached as to the benefit of the study.

Summary

The program of Industry and Technology for Contemporary Man was found unique in the one aspect of suggesting that educators draw their information for industrial arts studies not only from contemporary industry, but from subject areas of the schools as well. The program applied the anthropological approach to study certain basic elements common to all civilized mankind, and the contemporary approach for the study of American industry.

CHAPTER IV

Comparison of Programs

Summary of the Criteria Findings of Saskatchewan

On the basis of the eight criteria utilized in Chapter III, Saskatchewan's objectives emphasized that the purpose of industrial arts was the development of an understanding of industry and the development of talents in the technical fields and applied sciences. It had the further objective of developing and extending problem solving skills.

Regarding the source of content for industrial arts the Saskatchewan program emphasized an understanding of industry and technology to interpret the world of work.

in organizing and developing the content material for the Saskatchewan program the multiple activity environment was recommended.

It was indicated by the Saskatchewan program that industrial arts afforded the students an opportunity of career choices; especially in the junior high school grades. In the senior comprehensive high school (especially in the larger cneters) the students had to choose a core of basic matriculation subjects which were preparatory for an occupation leading directly into employment.

The method recommended for teaching industrial arts in the junior high schools is that of multiple activity. No methods are outlined in the senior high school curriculum bulletins.

The grade structure provided industrial arts for grades

eight and nine. The new curriculum guide (in the multiple activity labs) presented the opportunity for a student in the junior high school to be intorduced to at least nine different areas in industrial arts. All senior high school grades were permitted to choose (as an option) one industrial arts subject per year.

To meet the teaching requirements for industrial arts in the Province of Saskatchewan, the Department of Education offers university classes leading to a general Bachelor of Education Degree. No special student teaching is offered in multiple activity labs for industrial arts university students.

In the 1967-68 school year Saskatchewan had a number of industrial arts experimental programs in operation. The teachers involved in the experimental projects advocated more similar projects, and recommended that the program be offered to grades seven through nine.

Comparison of the Other Four Programs Combined

The information of the study disclosed that the objectives of the four programs emphasized the importance of exploratory learning, problem solving, and introducing the students to a multiplicity of career opportunities that society has to offer today.

All four programs chose the source of content for their curriculum material directly from industry. Three of the four programs (Alberta, American Industry, and IACP, (Industrial Arts Curriculum Project)) employed the Pert method to develop their

program, while the fourth (Maryland) developed its program on the basis of research and development in view of the need of the individual.

Of the four programs only the Maryland program was highly orientated to vocational training at the hi h school level. The American Ind stry and IACP programs did not provide for a senior high school program. The American Industry program provided for a smooth transition from general education to vocational education, while the Alberta program provided for an introduction to the multiplicity of career opportunities both in junior and senior high schools.

In all four programs the students' activities revolved around experimentation and problem solving. The American Industry program had a definite two-part construction and manufacturing according to the world of work. Basically, all programs stressed the importance of understanding the world of work.

All program planners considered it vital that either all or part of the junior high school students be given industrial arts in some form of multiple activity teaching. Only the Alberta and Maryland programs had completed plans for the senior high school industrial arts, with the latter program placing emphasis on vocational preparation.

Special training for industrial arts teachers was provided for by all four programs. Not all the teacher training programs were the same in content. For example, the Maryland University offered Industrial Education under three administrative curriculums.

The three curriculums were administered by the Industrial Education Department as: (1) Industrial Arts Education, (2) Vocational-Industrial Education, and (3) Education for Industry.

Field testing or a form of research was carried out by each program. No final curriculums have been developed, but as the results of the research work are finalized, it is expected that curriculums will be fully developed.

A Comparison of Programs by Criteria

Objectives

It was found that Saskatchewan, as well as the other four programs, emphasized the importance of developing an understanding of our changing industry and its place in culture. The Saskatchewan study considered problem solving (as it is related to industry) important enough to place it into its main objectives, similar to that of the American Industry Program, IACP, and Maryland's Program. All five programs, whether directly or indirectly, encouraged the discovery method as important for industrial arts. The Saskatchewan program was the only one that mentioned "to develop a measure of skills in the use of common tools and machines."

Vocational Preparation

Saskatchewan and Maryland programs offered a vocation education program in the senior high school. For example, in Saskatchewan the exploratory year in business and technology fields was begun in grade ten. The students explored a variety of areas in preparation for the selection of a specialty for grades eleven and twelve. The Maryland program provided for exploratory

experiences of value for the student in his selection of avocational or professional pursuits.

The Saskatchewan program was the only one that did not advocate industrial arts for grade seven.

Further study of the Saskatchewan program revealed a separation of high school programs into two curricula, one including industrial education (vocationally inclined) and the other the vocational-technical education. A curriculum of this nature seemed to eliminate the industrial opportunities from the pre-university student.

Chapter IV completed the comparisons of the five industrial arts programs. Chapter V is a summary of the study. It includes conclusions of industrial arts, and discusses briefly the recommendations of the study.

CHAPTER V

Summary, Conclusion, and Recommendations

Summary of the Study

The purpose of this study was to describe the program of industrial arts education in the Province of Saskatchewan and compare it to selected contemporary industrial arts programs.

Criteria used in the description and comparisón were derived at by establishing commonalities within the five programs under study. For example, all the five programs considered that the objectives were of utmost importance in developing an industrial arts program. For this reason this criterion was placed first. Second, all the programs stated the need of obtaining their industrial arts program material from industry. Further, there were many and various different criteria mentioned throughout the five programs, but the eight criteria used in this study were common to all programs, but not all programs gave equal consideration to each criterion used in the study.

The study proceeded from the information available from recent literature of the five programs, and was conducted by analyzing the literature in the field of industrial arts education.

Conclusions

Eight characteristic criteria established the design of this study. The exposition of the data gathered in research of each of these criteria resulted in the following conclusions.

Description and comparison of objectives

From the review of the objectives of the five programs, it appeared evident that all programs concerned were interested in objectives that would develop an appreciation of the scientific approach of problem solving in the industrial arts laboratories. Also, all programs considered the choice of objectives (for their industrial arts programs) as the most essential part of the whole program.

Source of content for industrial arts

There appeared to be a consensus in all the programs that the industrial arts curriculum subject matter should be gleaned from industry of the immediate areas, province, state or country, and even include certain phases of world-wide information.

Organization and development of content

This varied greatly in the five programs. It varied in that one university used the research and development approach; another applied the structuring of the body of knowledge approach; still another used the conceptual approach; and the fourth and fifth, the multiple activity approach. Nevertheless, each individual program was organized with industry in mind for the actual classroom participation.

Provision for Vocational Education and Career Preparation

In the junior high school mentioned was made in relation to making students aware of the occupations available in the world of work. Two programs emphasized the importance of a student knowing the tasks to perform for career preparation and tasks needed immedi-

ately upon job entry and those tasks needed soon after job entry. One program stressed that no vocational preparations be made in either the junior or senior high school courses, but that students be made aware of what occupations are available so a more intelligent choice can be made. Two programs dealt with the junior high school only, but mentioned nothing about vocational and career preparations in these programs.

Activities carried out and Methods Used

Activities and methods were developed to suit the needs of the individual program objectives. For some programs it meant only a few and brief objectives, while for others it meant main objectives, sub-objectives, and functional objectives, and for still another program it meant many objectives for every day of the school year.

Grade structure for Industrial Arts

It was distinctly apparent that every program emphasized the importance of industrial arts education for junior high school first and later possibly for both junior and senior high schools. Two programs did not consider senior high school industrial arts; one program offered industrial arts for all junior and senior high school students, and two programs offered a form of vocational/industrial arts combination courses.

University Programs

All universities involved in this study offered special programs of training for industrial arts teachers, but not all gave the students the opportunity of student teaching in special industrial arts labs. Yet they all concluded that it was important that

that student teachers be given this opportunity.

Experimentation

It revealed conclusive evidence that it was important to experiment by means of pilot projects (and various other means) before a complete curriculum innovation be made. The pilot research led to fairly detailed reports by some porgrams, trial curriculum material for others, a prospective curriculum for one, and a temporary acceptance of a curriculum for another.

Recommendations

Recommendations resulting from the findings in this study were dealt with in relation to industrial arts in general, and not any one program in particular.

Recommendations for Industrial Arts Education

1. It was found that all programs placed positive importance on the objectives of their programs. It is therefore recommended that special attention be given in the choice of objectives taking into consideration the geographical location, industry within the area, and the general world of work.

2. Each of the five programs had planning as an important aspect. Therefore, it is recommended that planning be emphasized. For example, the PERT (Program Evaluation Review Technique) could be utilized in planning industrial arts programs.

3. The study revealed that technological growth is occurring at an exponential rate. It would therefore be advisable to have a continuing research and planning body for the purpose of keeping educational organizations informed as to the most recent

developments, in the field of industrial arts and the world of work.

Implications for Saskatchewan Education

In considering the objectives of the Saskatchewan industrial arts program it would appear that the multiple activity labs are favored in the teaching of Division III industrial arts. Some of the junior high schools of Saskatchewan experimented with the multiple activity labs during the 1967-68 school year.

The multiple activity environment would be required if the objectives of the Saskatchewan Junior High School Program were implemented. The program required that a student be given the opportunity to develop an understanding of industry, learn by the discovery method, and by experimenting and using problem solving methods.

Since the source of content was from industry, it would indicate that a flexible time table would be advisable. It would assure more up-to-date curriculum material.

It was found evident from the vocational emphasis given in the junior and senior high school curriculum in Saskatchewan that the students would have to make an early career decision. For example, by the time a student reached grade ten (or about age fifteen) he would have to prepare to specify his career preference. The Maryland program would appear to agree with this procedure, but the Alberta program advocated industrial arts (without the emphasis of vocational education) completely through the senior high school years.

The criterion of activities and methodology would again imply

that the multiple activity labs would be required. The multiple activity organization of industrial arts affords the opportunity for the students of becoming acquainted with the industrial procedures as required by the Saskatchewan industrial arts program.

From the few pilot projects (in multiple activity industrial arts labs) that Saskatchewan introduced last year it appeared that the industrial arts teachers involved in the projects were very favorably impressed. The projects were well received by the students, and showed real promise for a broader and more liberal education to meet the needs of the present society. According to the objectives stated in the Saskatchewan Industrial Arts Program Curriculum it would appear that to develop an understanding of our changing industry and its place in our culture the multiple activity program would serve to achieve these objectives.

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APPENDIXES

APPENDIX A

LETTERS

UNIVERSITY OF MARYLAND
COLLEGE PARK

DEPARTMENT OF INDUSTRIAL EDUCATION
COLLEGE OF EDUCATION

April 3, 1968

Mr. Pete P. Driedger
10902-79th Avenue
Edmonton, Alberta
Canada

Dear Mr. Driedger:

I am responding to your letter of March 26, in which you requested information about the programs we have developed.

Enclosed you will find several items that should be of some assistance to you.

Thank you for your inquiry.

Sincerely yours,

Donald Maley

Donald Maley
Professor and Head

Enclosures

DM:lf

STOUT STATE UNIVERSITY
MENOMONIE, WISCONSIN
54751

April 23, 1968

Mr. Pete P. Driedger:
10902 79th Avenue
Edmonton, Alberta
Canada

Dear Mr. Driedger:

Enclosed you will find several papers which explain some of the various dimensions of our Project.

I have added your name to our mail lists so that you will receive news-letters as they are developed.

If after reading this material, you have any questions, feel free to write at any time.

Sincerely,

AMERICAN INDUSTRY PROJECT

W. L. Face

W. L. Face, Co-Director

WLF:pv
Enc.

industrial arts curriculum project

THE OHIO STATE UNIVERSITY 1712 NEIL AVENUE COLUMBUS, OHIO 43210 TELEPHONE: 614, 293-7471

EDWARD R. TOWERS

DONALD G. LUX

WILLIS E. RAY

April 9, 1968

Mr. Pete P. Driedger
10902 79th Avenue
Edmonton, Alberta
Canada

Dear Mr. Driedger:

Your letter of March 26 requesting information about the Industrial Arts Curriculun Project (IACP) was directed to me.

The topic of your master's thesis sounds like a most interesting assignment, one that I would be interested in reading. You did not mention what three programs in addition to the IACP are being compared with the Saskatchewan program. Also you neglected to specify the specific kinds of information you need to analyze as part of your study. However, the following should provide you with some basic information regarding our program.

IACP has completed its first draft of instructional materials to be used in a junior high school course titled, "The World of Construction" semester one and two. This instructional program is being field tested with 1,300 youngsters in 12 schools in Cincinnati, Ohio; Trenton-Hamilton Township-New Brunswick, New Jersey; and Miami, Florida. Teachers and supervisory staff from these three centers spent from two to eight weeks at The Ohio State University last summer receiving training on how to implement this "new industrial arts" program. Our staff has begun to evaluate the first year course in "Construction" and will revise this material based on feed-back and recommendations of field center teachers, pupils, professional consultants, and technical experts.

Drafts of "The World of Manufacturing" our second year course are now being developed. We are hopeful to complete the instructional materials for "Manufacturing" semester one by June, 1968 in time for our summer teacher training workshop. Three additional field centers have been added for the 1968-69 academic year in California, Illinois, and Texas. In September, 1968, we will have 48 teachers, 6 field directors, and 5,000 students enrolled in both courses in six states.

Our instructional system includes a textbook, workbook, laboratory manual, and a teacher's guide. In addition, specially designed teaching aides, such as mockups, transparencies, models, and materials and instruments needed for laboratory activities, are provided by IACP. Presently, they are not available to anyone other than those assisting in their development and testing. Budget limitations for publications have caused us to develop this policy. All of the curriculum materials developed by the IACP will be available after field testing and revisions have been completed.

The pupils, teachers, supervisors, and industrial arts teacher educators who are participating in field testing IACP instructional materials are very enthusiastic about the program. Although we cannot provide you with instructional materials at this time, your name will be placed on our mailing list, if you so desire, so that we may provide you with information about subsequent developments about the IACP.

If you would like to obtain a copy of our 358 page statement of philosophy and knowledge structure of industrial arts, may I suggest that you order a copy of A Rationale and structure for Industrial Arts Subject Matter. It will be available in microfishe for $1.50 or hardcover for $15.28 sometime this month. The document acquisition number is VT003203. For further information write to:

Retrieval Specialist
ERIC Clearinghouse
The Center for Vocational & Technical Education
The Ohio State University
980 Kinnear Road
Columbus, Ohio 43212

I am enclosing a few publications which will give you some further information. A new brochure which will provide more comprehensive explanation of the structure of the IACP along with sample instructional materials should be soon completed and will be mailed to you.

I hope this general information and the enclosed material will help you with your thesis. Good luck in your final assignment for your master's degree at the University of Alberta.

Please give my regards to Dr. Ziel and also to my good friend, Dr. Tichenor.

Very truly yours,

James J. Buffer, Jr.
Director of Dissemination
and Research Evaluator

JJB:je

Enclosures

IACP industrial arts curriculum project
THE OHIO STATE UNIVERSITY 1712 NEIL AVENUE COLUMBUS, OHIO 43210 TELEPHONE: 614, 293-7471
EDWARD R. TOWERS
DONALD G. LUX
WILLIS E. RAY

June 10, 1968

Mr. P. P. Driedger
10902 79th Avenue
Edmonton, Alberta Canada

Dear Mr. Driedger:

Your research study sounds like it will be an interesting and time consuming task. I would be interested in reviewing your results.

Let me attempt to answer your two questions. Our program was developed for grades 7 through 9 and is currently being taught at those levels.

We do not have any immediate plans for developing curricula for the senior high school. We do not have the staff, time, or money to undertake the development, production, implementation, and testing of additional instructional materials. Our current committments are too great.

You would profit from visiting one of our field centers to see the IACP program in operation. Stop in to visit us if you happen to be driving through Columbus in the near future.

Good luck in your research.

Sincerely,

James J. Buffer, Jr.
Director of Dissemination
and Research Evaluator

JJB:jc

APPENDIX B

SASKATCHEWAN UNIVERSITY PROGRAM FOR INDUSTRIAL ARTS TEACHERS

APPENDIX B

SASKATCHEWAN UNIVERSITY PROGRAM FOR INDUSTRIAL ARTS TEACHERS

Academic Requirements:

1. English 102
2. A social science
3. Mathematics
4. Physics or Chemistry
5. One Arts and Science elective
6. Two senior classes in appropriate academic subjects.

Technical Requirements:

Beginning with the 1967-68 university term, all candidates for the Bachelor of Education Degree Program for Industrial Arts Teachers will enroll for the Industrial Arts technical year at the Saskatchewan Insitute of Applied Arts and Sciences, Saskatoon. Satisfactory completion of the technical year will be prerequisite for further work in the Industrial Arts B. Ed. Degree Program. The Technical year at the Saskatchewan Institute of Applied Arts and Science is equivalent to the following classes:

1. Education 170: Materials and Processes I
2. Education 171: Materials and Processes II
3. Education 172: Materials and Processes III
4. Education 173: Energy and Power I
5. Education 174: Energy and Power II

Professional Requirements:

1. Education 270: Foundations of Vocational Education and Industrial Arts
2. Education 271: Curriculum in Vocational Education and Industrial Arts
3. Education 272: Communications (Processes, Media and Problems)
4. Education 277: Methods of Teaching Vocational Subjects
5. Education 110: Growth and Learning
6. Education 310: Educational Psychology
7. Education 401: Foundations of Education
8. One Education elective

The Department of Education may issue a Standard B Certificate to a student who has satisfied the technical requirements and has completed five classes of the professional requirements of the degree program.

COURSES FOR INDUSTRIAL ARTS TEACHER EDUCATION, TECHNICAL YEAR 11/18/66

FIRST SEMESTER

Materials Processing ----derivation of basic materials; refining and synthesizing; foundry and forging; pressure forming; chemical processes.

Materials Science---------structure of matter; properties and characteristics of materials; heat treatment and alloying; strength of materials; comparitive testing.

Graphic Communications---descriptive geometry; graphical mathematics; graphic reproductions; basic photography layout and paste-up techniques.

Circuits and Components--basic electrical phenomena; functions of basic circuits; characteristics of fundamental components; magnetic circuits.

Basic Mechanics----------statics of solids; fluid statics; dynamics of solids; fluid dynamics.

IA Laboratory-------------orientation to multiple-activity laboratory; operation techniques; preparation and demonstration of suitable laboratory problems.

SECOND SEMESTER

Production Processing-----machine tool principles; machine tool operation; cutting and shearing technology; production economics.

Design Processing---------applied strength of materials; design economics; market considerations; design project.

Information Processing---data derivation; data organization; analysis of data to derive pertinent information; introduction to logic systems; basic computer methods.

Energy Conversion---------basic principles of thermo-dynamics; thermo- mechanical systems; electro-mechanical systems; survey of energy sources and utilization.

Mechanisms and Machines--basic kinematics; kinematics of of some typical mechanisms; mechanical motion transmission; machine

	design considerations; basic synthesis.
IA Laboratory-------------	continuation of educational laboratory techniques; analysis of a typical industrial operation and its interrelation with socio-economics.

ENTRANCE

Senior Matriculation (Sask. Gr. XII) including mathematics and physics.

TERM

Each course will be presented in approximately 2 hours of lecture-discussion (+ 4 hours of individual assignments) and 3 hours of laboratory activity per week; each semester is approximately 18 weeks (Course Pamphlet, 1966).

APPENDIX C

ALBERTA UNIVERSITY PROGRAMS OF INDUSTRIAL ARTS

APPENDIX C

ALBERTA UNIVERSITY PROGRAMS OF INDUSTRIAL ARTS

The Department of Industrial and Vocational Education, Faculty of Education, University of Alberta, offers the only degree programs in Industrial Arts Education in the Dominion, including the following:

Bachelor of Education of Industrial Arts
Graduate Diploma in Industrial Arts
Master of Education in Industrial Arts
(Bulletin I, Industrial Arts, 1966g, p. 16)

The University Programs were outlined as follows (Bulletin I, Industrial Arts, 1966f, p. 17):

University Programs of Industrial Arts in Alberta

Bachelor of Education

Admission Requirements

Alberta High School Matriculation, consisting of a High School graduation Diploma with "B" (50%) or higher standing in each of the course of Grade XII as set forth below, and an average of at least 60% in these courses: English 30, Social Studies 30; Four of: Math 30, Chemistry 30, Physics 30, Biology 30, Math 31, Music 30, French 30, German 30, Latin 30.

A basic program leading to the Bachelor of Education in Industrial Arts includes:

FIRST YEAR

1. Ed. I.A. 203 and Ed. Adm. 261
2. Ed. Psy. 276
3. English 210
4. Approved Mathematics course
5. Ed. I.A. 260
6. Physical Education 218

SECOND YEAR

1. Approved Chemistry course
2. Ed. C.I. 250
3. Approved Physics course
4. Approved Social Science course
5. Ed. I.A. 270

Certification: Interim Standard S Certificate

THIRD YEAR

1. Ed. Psy. 476
2. Philosophy 240 or 242
3. Approved Arts or Science option
4. Ed. I.A. 360
5. Ed. I.A. 370

Certification: Interim Professional Certificate

FOURTH YEAR

1. Ed. Fdn. 492
2. Approved Social Science course
3. Ed. I.A. 350
4. Ed. I.A. 460
5. Ed. I.A. 470

The Program provides credit toward Alberta Certification and salary entitlement. Successful completion of the four year program entitles the student to a Bachelor of Education in Industrial Arts.

Graduate Diploma

This program provides additional special qualifications in industrial arts education for holders of the B. Ed. in Industrial Arts degree who wish to continue advanced study before undertaking a formal Master's Degree program. Admission to the Graduate Diploma program will be granted to holders of an approved degree and a professional teaching certificate or its equivalent. Courses credited toward the Diploma may not also be credited toward the B. Ed. degree. The pass mark for course to be credited toward the Diploma is 65%. Residence requirements for the Diploma may be met in consecutive summer sessions or in a winter session.

The Program:

The candidate's program of courses is designed in consultation with an advisor, to meet his particular career needs and interests. The candidate is encouraged to examine courses in other departments for optimal professional development.

Courses:

Typically, candidates elect several of the Industrial Arts courses listed in conjunction with other faculty offerings.

Ed. I.A. 260 General Industrial Arts (3-6; 3-6)
Ed. I.A. 270 Introduction to Technology (3-6; 3-6)
Ed. I.A. 370 Technology I (2-4; 2-4)
Ed. I.A. 460 Technology II (2-4; 2-4)
Ed. I.A. 470 Technology III (2-4; 2-4)
Ed. I.A. 350 Educational Programs and Practices in Industry and Labour (3-0; 3-0)

Ed. I.A. 360 Laboratory of Technology (2-4; 2-4)
Ed. I.A. 594 Research and Development Seminar in Industrial Arts Education (3-0; 3-0)
*Ed. I.A. 589 Organization of Industrial Arts Education (3-0; 3-0)
*Ed. I.A. 591 Problems and Trends in Industrial Arts Education (0-0; 3-0)

*These are half courses.

Master's Degree Program

This program serves holders of the B. Ed. in Industrial Arts degree who wish to pursue careers as teachers, supervisors, or administrators of Industrial Arts Education. Residence requirements for the Master's Degree in Industrial Arts may be met in consecutive summer sessions or in a winter session.

The Program:

Normally a candidate for the Master's Degree must present a program consisting of 6 courses and a minor thesis. The candidate's program of courses is designed in consultation with an adviser to meet his particular needs and interests. In general, candidates pattern their programs from offerings of the Department of Industrial and Vocational Education and other departments of the University. The candidate is encouraged to consider courses in other departments for optimal professional growth. Before being admitted to the Master's Degree Program the candidate must first submit a record acceptable to the Faculty of Graduate Studies.

Courses

The typical program consists of the equivalent of two full courses offered by the Department of Industrial and Vocational Education and four courses offered by other departments of the University. The courses which are required of all candidates are:

*Ed. I.A. 589 Organization of Industrial Arts Education (3-0; 0-0)
*Ed. I.A. 591 Problems and Trends in Industrial Arts Education (0-0; 3-0)
Ed. I.A. 594 Research and Development Seminoar in Industrial Arts Education (3-0; 3-0)

*These are half courses.

The remaining four courses are selected on the basis of the candidate's projected career pattern as a master teacher, supervisor, or administrator. For example, a candidate who intends to pursue a

career as a supervisor may elect courses in curriculum, instruction, educational administration, and related fields.

APPENDIX D

APPENDIX D

BACHELOR OF SCIENCE PROGRAM IN

INDUSTRIAL ARTS EDUCATION

APPENDIX D

BACHELOR OF SCIENCE PROGRAM IN INDUSTRIAL ARTS EDUCATION

At Stout State University

Menomonie, Wisconsin . Vacationaland, U. S. A.

The industrial arts education program provides the basic preparation for teaching industrial arts in elementary and secondary schools. The students enrolled in the program gain experiences in the technical specialty they desire, in contemporary teaching methods, and in liberal studies which promotes intellectual growth. The technical specialty the student wishes to pursue is accomplished by selecting one of the many technical concentrations: electronics, graphic arts, industrial graphics, mechanics, metals, woodworking, plastics, or general industrial.

Curriculum

The curriculum of the industrial arts education program requires four academic years at the end of which the Bachelor of Science Degree is awarded. The total number of semester hours credit needed are 130 made up of 42 technical credits and 88 academic credits. Each candidate in the program is required to complete a 22 credit minor ot two 15 credit concentrations. A general description of the curriculum follows:

Academics		Education	Technical
English	History	Secondary Education	Drafting
Speech	Physical Ed.	Psychology	Metals
Mathematics	Chemistry	Introduction to Teaching	Printing
Psychology	Physics		Woodworking
Sociology	Government	Curriculum Development	Mechanics
Economics	Art	Guidance	Plastics
		Student Teaching	Electronics

Profession Opportunities

Each year the Stout State University Placement Office receives hundreds of notices of teaching positions open in the field of industrial arts education. These positions include elementary, secondary, and college teaching opportunities. Positions as camp counselors for various summer camps are also available to persons with industrial arts training. Industrial arts education

Many graduates in this field have also found employment in industry, expecially in the area of product education.

For further information regarding this program contact:

Director, Industrial Arts Education,
School of Applied Science & Technology

APPENDIX E

UNIVERSITY REQUIREMENTS AND PROGRAMS OF THE OHIO STATE UNIVERSITY

APPENDIX E

UNIVERSITY REQUIREMENTS AND PROGRAMS OF THE OHIO STATE UNIVERSITY

I. GENERAL UNIVERSITY REQUIREMENTS
(Listed on pages 259-260).

**Education 605--Problems in the Teaching of Biological Science, may be substituted for Education 681 for students having 30 hours of biological science.

II. GENERAL COLLEGE REQUIREMENTS
(Listed on page 259).

*Students who have had geology or earth science in high school are encouraged to take a proficiency examination for Geology 416. If successful, the student will then be able to add a 5-hour elective course supporting the earth-science major.

III. UNIVERSITY BASIC EDUCATION REQUIREMENTS
(Listed on page 259)

1. Science: 15 hours
   - Physics 411, 412--General Physics. . 10 hours
   - A course in Biological Science . . . 5 hours
2. Social Science: 15 hours
   - Psychology 401--General Psychology 5 hours
   - Sociology 401--Introductory Sociology
   - Sociology 402--Social Trends and Problems or Economics 501, 502--Principles of Economics . . . . 10 hours
3. Humanities: 15 hours
   - Fine Arts 401--Introduction to Fine Art Activities 3 hours
   - Additional Requirements . . . . . . 12 hours

IV. CONTENT COURSES IN MAJOR AREA
80 HOURS

Education 440--The Laboratory of Industries	4 hours
Education 441, 442--Elements of Woodworking	8 hours
Education 443, 444--Elements of Metal-working	8 hours
Education 445--Elements of Printing	4 hours
Education 446--Elements of Electricity in Industrial Arts	4 hours
Education 450--Introduction to Power Mechanics	4 hours

Education 460--Problem Planning in Industrial Arts	3 hours
Education 560--Letter Press and Offset Printing	4 hours
Education 585--The Handicrafts	4 hours
Engineering Drawing 400--Elementary Engineering Drawing.	4 hours
Engineering Drawing 402--Principles of Engineering Drawing	4 hours

Select 29 hours from the following:

Education 451--Internal Combustion Engines	4 hours
Education 456--Residential and Industrial Utilization of Electric Power	4 hours
Education 581--Work Experience in Industry	3-6 hours
Education 600G--Industrial Arts Education	1-4 hours
Engineering Drawing 504--Technical Drawing	4 hours
Engineering Drawing 506--Structural Drawing	4 hours
Engineering Drawing 508--Production Illustration	4 hours
Fine Arts 484--Introduction to Ceramic Art	3 hours
Fine Arts 534--Sculpture Design Materials	5 hours
Fine Arts 610--Furniture Design	5 hours
Industrial Engineering 404--Foundry Practice	3 hours
Photograph 511--Photography.	3 hours
Welding Engineering 415--Forging, Heat Treating, and Welding	3 hours

V. REQUIRED PROFESSIONAL COURSES

Education 408--Introduction to the Study of Education	3 hours
Education 535--Theory and Practice in Secondary Education	5 hours
Education 536G--Student Teaching in Industrial Arts	9 hours
Education 561--The Teaching of Industrial Arts I	3 hours
Education 562--The Teaching of Industrial Arts II	3 hours
Education 563--The Teaching of Industrial Arts III	3 hours
Education 636--Historical Foundations of American Education	4 hours
Education 607--Philosophy of Education .	3 hours
Health Education 610--Health Education for Secondary Teachers	3 hours
Psychology 407--Educational Psychology .	5 hours

Industrial Arts Club is open to all students in industrial arts education. The purposes of the club are to foster social and professional relationships, develop leadership, and promote increased knowledge of industrial arts. Members receive a subscription to the Industrial Arts Teacher and student membership in the American Industrial Arts Association.

563 The Teaching of Industrial Arts III U 3
Sp. 3 cl.
Prereq.: 3rd yr. standing, and 561.

Problem design and presentation. Planning secondary school courses in drawing and the graphic arts. Methods of student evaluation. Correlation with other subject fields; industrial practice.

575 Trade and Industrial Education U 3-6
A. W. Sp. Cl. hrs. arr.
Prereq.: Temporary vocational teaching certificate in a trade of industrial subject, or eligibility for such certificate, and permission of instructor.
Repeatable to a maximum of 18 cr. hrs.

581 Work Experience in Industry U 3-6
A. W. Sp. Su. 5-2 hr. cl.
Prereq.: Major standing in Industrial Arts or Trade and Indust. Ed., and permission of instructor.
Credit in 505, 536, and 581 not to exceed 22 hrs.

A first hand study of the working conditions, methods, and processes of industry and their implications for the teaching of industrial arts.

585 The Handicrafts
W. W. Sp. 5-2 hr. cl., and lab.
Repeatable to a maximum of 12 cr. hrs.

Designed to develop skills and knowledge in the use of the common areas of handicrafts such as leather, metals, plastics, wood, and the graphic art.

600 G Industrial Arts Education

600H Trade and Industrial Education

600J Radio and Television Education

APPENDIX F

MARYLAND UNIVERSITY PROGRAM FOR INDUSTRIAL ARTS TEACHERS

APPENDIX F

MARYLAND UNIVERSITY PROGRAM FOR INDUSTRIAL ARTS TEACHERS

The industrial arts education curriculum prepares persons to teach industrial arts at the secondary school level. It is a four-year program leading to a Bachelor of Science degree. While trade or industrial experience contributes significantly to the background of the industrial arts teacher, previous work experience is not a condition of entrance into this curriculum. Students who are enrolled in the curriculum are encouraged to obtain work in industry during the summer months. Industrial arts as a secondary school subject area is a part of the general education program characterized by extensive laboratory experiences.

INDUSTRIAL ARTS EDUCATION CURRICULUM 1966-1968

	Semester I	Semester II
Freshman Year		
Eng. 1-Composition and American Lit.	3	..
Eng. 3-Composition and World Lit. or		
Eng. 4-Composition and World Lit.	..	3
Soc. 1-Sociology of American Life or for Modern Man or Psych. 1-Introduction to Psychology	3	..
P. Ed. 1, 3-Physical Activities	1	1
Sp. 1-Public Speaking	3	..
I. Ed. 1-Mechanical Drawing	2	..
I. Ed. 12-Elementary Woodworking	3	..
I. Ed. 12-Shop Calculations	3	..
Art-Art Elective or	3	..
Phil.-Philosopht Elective	..	..
Health 5-Science and Theory of Health	..	..
I. Ed. 21-Mechanical Drawing.	..	2
I. Ed. 22-Machine Woodworking	..	3
Total	15	17
Sophomore Year		
Eng. 4-Composition and World Lit. or	3	..
Eng. 3-Composition and World Lit.	..	..
History 21-History of U.S. to 1865 or	3	
History 22-History of U.S. since 1865	..	3
Hist.-History Elective	..	3
Phys. 1 2-Elements of Physics (Mechanics and Heat and Sound)	3	3
I. Ed. 28-Electricity I	3	..
I. Ed. 33-Automotives I	3	..
I. Ed. 41-Architectural Drawing	2	..
Math. 10-Introduction to Mathematics	..	3

I. Ed. 48-Electricity II	..	3
I. Ed. 23-Arc and Gas Welding	..	1
I. Ed. 110-Foundry	..	1
Total	17	14
Junior Year		
Chem. 1, 3-General Chemistry	4	4
Ed. 110-Human Development and Learning . . .	6	..
Ed. 111-Foundations and Education	..	3
I. Ed. 69-Machine Shop Practice I	3	..
I. Ed. 26-General Metal Work	3	..
I. Ed. 111-Laboratory Practices in Industrial Arts Education	..	3
I. Ed. 34-Graphic Arts I	..	3
I. Ed. 34-Graphic Arts I	..	4
Elec. -Elective (Laboratory)	4	..
Elec. -Elective (Unspecified)	..	3
Total	17	19
Senior Year		
I. Ed. 140-Curriculum, Instruction and Observation, Ind. Ed.	3	..
I. Ed. 148-Student Teaching in Secondary Schools	8	..
I. Ed. 145-Principles and Methods of Secondary Education	3	..
I. Ed. 164-Shop Organization and Management	..	3
I. Ed. 166-Educational Foundations of Industrial Arts	..	2
Econ. 37-Fundamentals of Economics	..	3
Elec.-Electives	..	6
Elec. -Electives (Unspecified)	..	3
Total	14	17

APPENDIX G

DIVISION IV HIGH SCHOOL

COURSE OFFERINGS

OF SASKATCHEWAN

APPENDIX G

DIVISION IV COURSE OFFERINGS

FOR UNIVERSITY ENTRANCE STUDENTS

OF SASKATCHEWAN

Grade X	Grade XI	Grade XII
Core Subjects	Core Subjects	Core Subjects
English 10	English 20	English 30
Social Studies 10	Social Studies 20	Social Studies 30
Mathematics 10	Mathematics 20	Mathematics 30
Science 10	or	or
Guidance	General Math 20	General Math 30
	A Science (one)	A Science (one)
	Physics	Physics
	Chemistry 20	Chemistry 30
	Biology	Biology 30
	General Science 20	General Science 30
	Guidance	Guidance
Electives	Electives	Electives
Academic	Academic	Academic
French 10	French 20	French 30
Latin 10	Latin 20	Latin 30
German 10	German 20	German 30
Ukrainian 10	Ukrainian 20	Ukrainian 30
Drama 10	Russian 20	Drama 30
Art 10	Drama 20	Music 30
Music 10	Art 20	Art 30
Geography 10	Music 20	Chemistry 30
Home Ec. 10	Geography 20	Physics 30
Industrial Arts 10	Physics 20	Biology 30
Physical Ed. 10	Chemistry 20	Gen. Science 30
	Biology 20	Home Ec. 30
Business	Gen. Science 20	Industrial Arts 30
Typing 10	Industrial Arts 20	Economics 30
Bookkeeping 10	Home Ec. 20	Geology 30
	Psychology 20	Bookkeeping 30
Voc. Indust.	Sociology 20	Shorthand 30
Voc. Agric. 18	Phys. Ed. 20	Phys. Ed. 30
Driver Ed.		
Industrial Arts 10	Business	Business
Tech. 13	Typing 26	Typing 30
2, 3, or 4 options	Shorthand 26	Shorthand 36
	Bookkeeping 26	Bookkeeping 36
	Calculating Machines 26	Calculating Machines 36

Grade X	Grade XI	Grade XII
	Economics 20	Economics 30
	Voc. Indust. Trades 26	Voc. Indust. Trades 34
	Voc. Agric. 28	Voc. Agric. 38
	Industrial Arts 20	2, 3, or 4 options
	2, 3, or 4 options	

DIVISION IV COURSE OFFERINGS

FOR ENTRANCE TO TECHNICAL INSTITUTES, TO THE TRADES,

TO BUSINESS, AS WELL AS FOR GENERAL COURSE STUDENTS

Grade X	Grade XI	Grade XII
Core Subjects	Core Subjects	Core Subjects
English 10 or 11	English 20 or 21	English 30 or 31
Soc. St. 10 or 11	Soc. St. 20 or 21	Soc. St. 30 or 31
Math. 10 or 11	*Math. 20 or 21	*Math. 30 or 31
Science 10 or 11	*Science (one)	*Science (one)
Guidance	Physics 20 or 21	Physics 30 or 31
	Chem. 20 or 21	Chem. 30 or 31
	Biology 20 or 21	Biology 30 or 31
	Gen. Sc. 20 or 21	Gen. Sc. 30 or 31
	Guidance	Guidance

. . . .

Grade X	Grade XI	Grade XII
Electives	Electives	Electives
Academic	Academic	Academic
French 10	French 20	French 30
German 10	German 20	German 30
Ukrainian 10	Ukrainian 20	Ukrainian 30
Art 10	Art 20	Art 30
Drama 10	Music 20	Music 30
Music 10	Drama 20	Drama 20
Geography 10	Physics 21	Geography 30
Home Ec. 10	Chemistry 21	Geology 30
Industrial Arts 10	Biology 21	Physics 30
	Gen. Sc. 21	Chemistry 31
	Geography 20	Biology 31
Business	Home Ec. 20	Gen. Sc. 31
Typing 16	Industrial Arts 20	Home Ec. 30
Bookkeeping 16	Psychology 20	Economics 30
Business Essentials 16	Phys. Ed. 20	Industrial Arts 30
		Typing 30
		Bookkeeping 30
		Phys. Ed. 30

Grade X	Grade XI	Grade XII
Voc. Tech.	Business	Business
Voc. Tech. 13	Typing 26	Typing 30
Voc. Agric. 18	Bookkeeping 26	Bookkeeping 36
Ag. Mechs. 18	Shorthand 26	Shorthand 36
Commerical	Office Prac. 26	Office Prac. 36
Cooking 14	Calculating	Calculating
Beauty Culture 14	Machines 26	Machines 36
Drafting 14	Merchandising 26	Merchandising 36
	Law 26	Economics 30
	Communications 26	Data Processing 36
		Secretarial Prac. 36
	Voc. Tech.	Economics 33
	Mech-Tech. 23	Communications 33
	Const.-Tech. 23	
	Elect-Tech. 23	Voc. Tech.
	Drafting-Tech. 23	Mech-Tech. 33
		Const.-Tech. 33
	Trades	Elect-Tech. 33
	Automotives	Drafting Tech. 33
	Welding 24	Automotives 34
	Machines 24	Welding 34
	Construction 24	Machines 34
	Electricity 24	Construction 34
	Commercial Cooking	Elect. Const. 34
	24 (16)	Commercial
	Beauty Culture 24	Cooking 34
	Voc. Ag.-Mech. 28	Beauty Culture 34
	Farm Mach. 28	Voc. Agric. 38
		Voc. Ag.-Mech. 38
		Farm Mach. 38

APPENDIX H

SUMMARY OF EIGHT CRITERIA

APPENDIX H

A summary of the Eight Criteria

SASKATCHEWAN PROGRAM

---

1. Objectives are (a) to develop an understanding of our changing industry and its place in our culture, (b) to foster discovery and development of talents in technical fields and applied sciences, (c) to develop a measure of skills in the use of common tools and machines, (d) to develop and extend problem solving skills related to materials and processes.

---

2. Saskatchewan's Curriculum Guide stresses industrial processes which make up the technology, and an understanding of industry and technology to interpret the world of work.

---

3. Multiple activity environment to provide a wide exploratory experience. This environment is to be in a possible 16 units, of which a minimum of 4 units to be selected from at least 3 basic areas a school year. Division III would cover from 7 to 10 units. This affords the opportunity to observe the interdependence of technologies and to visualize the basic tools, machines and processes in each of the technologies.

---

4. Senior high school curriculum is as yet not completed, but they do advocate that a broad spectrum of skills, knowledges, understandings, and attitudes be learned by the students, that will be directly related or applicable to most occupations.

---

5. Student activity is centered around testing, analysis, plan, design, experimentation, the study of fundamental tools, materials, and industrial processes. The students should also have an understanding of industry and technology.

---

6. The Saskatchewan industrial arts curriculum provides for teachers and facilities for the junior high school (Level III) of grades 7, 8 and 9, and for the senior high school (Level IV) of grades 10, 11, and 12. (At the present time it is advised in their curriculum that industrial arts begin at grade 8.)

---

7. The Program was planned for Industrial Arts teachers to meet the requirements for a general B. Ed. Degree to provide technical competence in the teaching major and to enable candidates to acquire a teaching minor in a chosen academic field. No special student teaching is offered in multiple activity labs for industrial arts university students.

---

8. Saskatchewan had fourteen Division III industrial arts projects in operation (not all pilot projects) during the 1967-68 school year. The Division III curriculum was printed in March, 1967.

ALBERTA PROGRAM

---

1. Objectives are (a) to reinforce the academic disciplines, (b) to provide exploratory experiences in the various productive aspects of society, (c) to provide a synthesizing educational environment, and (d) to provide an introduction to the multiplicity of career opportunities.

---

2. Source of content is representative of industry. Content is selected to form a core that is common to many fields; that is, those most prevalent in the field of industry and applications of basic science.

---

3. Phase I - Multiple Activity environment to utilize a pre-selected product matrix to optimize learning. Phase II - Selected technologies prevalent in the world of work. Phase III - The learning activities utilize simulated industrial situations focusing upon the various types of organizational structures, decision making, communications, and authority outline.

---

4. The Ziel Program of industrial arts provides the multiple activity environment introducing boys and girls to a variety of experiences designed to interpret the current Productive Society and provide a base to make a more intelligible vocational choice.

---

5. Student activity is centered around research, testing, analyzing, designing, experimenting, the study of tools, material, machines and processes, awareness and appreciation, decision making, communication, focus upon authority configurations, and interrelation of the technologies in the selected clusters.

---

6. The Ziel Program of the University of Alberta provides for an industrial arts program for all grades from 7 through 12. Grades 7 and 8 have the multiple activity environment of Phase I; grade 9, the selected technologies (7) prevalent to the world of work; grade 10 has Phase III of the role of man; grades 11 and 12, a cluster, Phase IV.

---

7. Bachelor of Education in Industrial Arts and Master of Education in Industrial Arts, with the view of a Doctorate in the not too distant future. Special Industrial Arts Student Teaching for every industrial arts university student. This involves all phases of the laboratory work, lesson planning and actual instruction one afternoon a week during the whole university year, for every student.

---

8. Research was carried on in Phases I and II. This was dealt with in detail in Part II of "The Ziel Program of the University of Alberta."

FACE AND FLUG PROGRAM

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1. Objectives are (a) to develop and understanding of those concepts which directly apply to industry, (b) to develop the ability to solve problems related to industry. The study of industry is so vital because of the emergence of technology as a force that molds our society.

---

2. Source of content was chosen of those concepts which directly applied to industry.

---

3. Face and Flug used the PERT method to develop their program. They used the conceptual approach to lead the students to understand the systems of concepts and sub-concepts applicable to all of industry and not just to a trade or some other narrow section of industry.

---

4. The conceptual approach was basically general education and not vocational education to prepare a student for a career. They feel that their approach offers a means of providing for a smooth transition from general education to vocational education in the acknowledgement of the need for all youth to have an understanding of American industry.

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5. Some of the activities carried out were: planning for mass production of wooden coaster and silk screened pennants, going on field trips, and posing labor-management problems and solving them through arbitration. Lessons were developed by introducing the themes as variants of concepts to be studied. Then the objectives for these lessons were developed and lesson lengths established. Then included television panel program, mass production, demonstration, etc.

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6. They have three courses--Level I in grade 8, Level II in grade 10, and Level III in grade 12. They also use Level I in grades 10 and 11.

7. They have a teacher education program on college level. They focus their training on developing the understanding of industry, the ability to solve problems, competence as a teacher, and personal competence as an individual and as a citizen. This program provides four years of laboratory experience and professional seminar. This allowed for integration of theory and practice, for an overview of the nature of industry and how it works, and a sophisticated understanding of the concepts of industry.

8. Feedback and revision of curriculum was carried out by all involved in the program. They rated their work, their teaching and their results. They also got a consultant to evaluate the American Industry Project Development.

TOWERS, LUX, AND RAY PROGRAM

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1. Objectives are to (a) understand the concepts, principles, generalizations, problems, and strategies of industrial technology, (b) have an interest in and an appreciation of industry as that element of economic system that provides industrial material goods for the satisfaction of human wants for those goods, (c) demonstrates knowledge and skills that will be useful in life situations of occupational, recreational, consumer, and socio-cultural significance. In general, they have a complex of objectives.

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2. They arrive at their content in relation to industry by means of identifying and structuring the knowledge of industry so as to be included in a study of industry, and preparing a program outline of selected elements of that knowledge--industrial arts.

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3. To develop their project, they structured the body of knowledge into logical divisions of knowledge, dividing it into four domains such as: (a) descriptive, (b) prescriptive, (c) praxiological, and (d) formal knowledge. By conceptualizing the structure of industry they made up a basis for content in industrial arts.

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4. Only the junior high schools are dealt with in this program, so the curriculum does not provide for vocational education or career preparation. It merely emphasizes that students be in such an environment that will enable them to make wise decisions affecting their occupational goals.

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5. The activities carried out were to gain experience in "The World of Construction" and "The World of Manufacturing." This resulted in actual activities as found in the world of work in construction and manufacturing.

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6. This program was arranged for junior high school only. This was to be a two-year articulated program.

7. Summer institutes were held for the teachers in parallel to the field testing of the materials. This pre-service collegiate teacher education program was designed to provide future industrial arts teachers with the new orientation and requisite knowledge and skills.

8. The "World of Construction" was field tested with 1,300 students in 12 schools. The "World of Manufacturing" is to be field tested in 12 additional schools in September of 1968. From these and other findings a new "industrial technology" curriculum will be fully developed, implemented, evaluated, revised, and made ready for adaptation in 1971.

MALEY PROGRAM

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1. The objectives are to (a) develop an appreciation of the scientific approach to problem solving, (b) develop a fuller understanding in the area of industrial research, (c) offer a meaningful program to teach tools, processes, and materials, (d) stimulate pupil interest in high level laboratory activities, (e) develop the student with respect to satisfying his own curiosity and developing self-reliance and the ability to do critical and analytical thinking, (f) provide exploratory experiences of value for the student in his selection of avocational as well as vocational or professional pursuits, (g) increase the individual's understanding and abilities in the area of consumer activities, and (h) develop in the student a feeling of creativity and satisfaction.

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2. The source of content has special relevance to the broad study of industry. As a curriculum area industrial arts is defined as those phases of general education which deal with industry. Industrial arts must also draw its content greatly from other subject areas in school.

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3. This program is organized and developed on the basis of "reaearch and development" approach. That is, the development of people, so not all get the same kind of industrial arts, but a program to meet the individual need.

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4. The cluster concept program in vocational education at the secondary level is highly vocationally oriented. For career preparation the tasks needed immediately upon job entry and those needed soon after job entry are stressed.

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5. The student activity centers around testing, analysis, and investigation of tools, materials, and processes. Again, activities are carried out so as to develop people.

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6. The seventh grade is the anthropological approach, eighth grade the contemporary approach to the study of American industry, the ninth grade program includes research and experimentation. The senior high school is the cluster concept in vocational education.

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7. Special institutes were held during the summer months to train industrial arts teachers. The actual courses available at the university of Maryland are administered by the Industrial Education Department using three curriculums as depicted in Appendix I.

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8. The first development was in 1952, and its introduction into the schools in 1959. Experiments were carried out at the junior high school level. Pilot projects were in the various fields of industry, such as coal industry, wood, metal, power generation, ceramics, transportation, textiles, etc.
